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THE PROPER ROLE OF VACCINES IN CHRONIC INFECTION OF THE UPPER AIR PASSAGES.*

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The chronic infections of the upper air passages that will be considered are those produced primarily by bacterial infection and not those due to lack of vitamins, to endocrine disturbance or to non-bacterial allergy.

SIGNIFICANCE AND MANIFESTATIONS OF CHRONIC UPPER RESPIRATORY INFECTION.

The presence of infection indicates that bacteria, against which the patient lacks resistance, are present in his tissues, multiplying there and elaborating toxins inimical to him. Chronicity implies that the patient's defenses have broken down more or less permanently, so that antibodies are not produced in sufficient quantity to destroy the infecting microorganisms, prevent their propagation or neutralize their toxic products.

Any portion of the nose, throat or ear may be the seat of local inflammatory reaction to the microbic invasion.

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Wherever situated, the infecting germs elaborate toxins, which are absorbed into the patient's tissues and circulation, with a resulting toxemia, the symptoms of which are many and varied. The more common toxic symptoms are anorexia, malnutrition, loss of weight, lack of energy and of ambition—with resultant reduced efficiency, languor, fatigability, weakness, malaise, pallor, anemia, headache, general and traveling aches and pains, especially in the back and limbs, vertigo, drowsiness, somnolence and a tendency to awaken unrefreshed in the morning and to experience difficulty in rising. Rarer general symptoms are fever, sweating, chilliness, rigors and the vomiting of acidosis. Some of the toxic manifestations simulate disease of the various systems, believed by Horder[1] to be due to an affinity of the toxin for the different tissues. Thus, heart disease is often suggested by symptoms of dyspnea, palpitation, tachycardia, arythmia, faintness, fainting and exhaustion, by the other signs of asthenia already described, and occasionally by pseudo-angina pectoris. Toxemia may also show itself in a myriad of nervous symptoms, including nervousness, irritability, neurasthenia, paresthesias, paralysis, convulsions and especially gastric hyperesthesia—commonly called nervous indigestion, with eructation, aerophagia, pyrosis, heartburn, gastric and abdominal pains, nausea, vomiting, increased and visible peristalsis, flatus, intestinal spasm, etc. Even psychic phenomena may occur, such as a tendency to mental tire, difficulty in concentrating, psychasthenia, hysteria, hypochondriasis, introspection, depression, melancholia, phobias, delirium and even some forms of mental disease.

Patients presenting these toxic symptoms, produced by a chronic bacterial infection of the upper air passages, frequently are treated by neurologists, cardiologists and gastroenterologists, to say nothing of general practitioners, without the infective nature of the complaint being recognized or even suspected.

The invading germs often are carried by the blood-stream or through the lymph-channels from the primary focus of infection in the upper respiratory tract to other tissues and to various organs, where they find lodgment and multiply, sending forth their toxins also from these secondary foci of infection. The toxins produced at the primary focus may likewise produce disease in distant tissues and organs. In

this manner focal infection is responsible for many of the disorders of the circulatory, respiratory, alimentary, genito-urinary, nervous, endocrine and lymphatic systems, as well as of the skin, muscles, joints, bones and eyes. These facts are recognized by many internists, pediatrists, urologists and general practitioners, and by some ophthalmologists, but seem largely to be ignored by most neurologists, dermatologists, surgeons, obstetricians and physicians in general practice. Bloomfield,[2] however, regards this causal relationship of foci of infection to "systemic" or to remote disease as still remaining largely *sub judice*.

Many cases of dental infection, particularly in non-vital teeth, instead of being primary foci, in my opinion[3] are secondary to a primary focus in the nose and throat, a belief held also by Hardwick.[4]

The otolaryngologist therefore holds a key position with regard to many human ailments. General practitioners and specialists look to him not only to cure the infection in the upper air passages, but also to remove all foci of infection there.

FREQUENT FAILURE OF THE OTOLARYNGOLOGIST TO CURE OR REMOVE A FOCUS OF INFECTION.

Although this latter appears on its face a simple assignment, otolaryngologists themselves attest to the frequent failure of both conservative and radical measures to accomplish it.[5-26] Unfortunately, this failure has produced in some physicians a feeling of skepticism as to the whole theory of focal infection and has caused them to ascribe etiological significance to factors of little or no importance. It also has created in the minds of many among both the profession and the laity the impression that sinusitis is incurable and is only aggravated by operation.

The belief that the otolaryngologist is able to remove a focus of infection is due, in my opinion, to a misconception on the part of physicians in general as to its nature.[27] Focal infection has been defined as a circumscribed area of tissue infected with pathogenic organisms.[28] When infected tissue is removed, most physicians apparently believe that the infecting pathogenic organisms are removed with it, on the

theory that the latter can thrive only in abnormal tissue. They seem to forget that absence of antibodies was the factor that permitted the microbe to chronically infect the tissue and that these lacking antibodies are not restored simply by the eradication of the diseased tissue. Another fact not generally recognized is that infecting bacteria are not necessarily confined to a circumscribed area, but frequently spread to adjacent tissues. The same germs that are in the tonsil, for instance, may be found in other portions of the fauces, especially in infratonsillar and pharyngeal lymphoid tissue, and in the nasopharynx,[29] where after tonsillectomy they remain, then occupying in addition the empty tonsillar fossae. Here they continue to elaborate poisons, which keep up the toxemia, and thus they still may infect distant tissues and organs until such time as they are overcome by the patient's resistive forces. Similarly, after drainage and lavage of an infected sinus, and even after the removal of its infected lining and the underlying necrosed bone, the infecting organisms frequently persist in the sinus, in the nasal passages and in the nasopharynx, where, in the absence of restraining antibodies, they keep up the infection and may again produce polypoid degeneration.

If, in their conception of focal infection, physicians stressed more the bacterial element and regarded the infecting bacteria as the chief etiologic agent,[31] they would realize that the surgeon's knife cannot completely remove a focus of infection, because the invading microbes, which always are an important part of it, are combated only by the patient's defensive forces. Comparisons of groups of tonsillectomized and untonsillectomized children consequently lose much of their value, for a tonsillectomized child that still harbors the infecting organism scarcely can be expected to be less susceptible to disease simply because his tonsils have been removed.

Infecting germs in a secondary focus, which they have converted into a favorable habitat where they are able unmolested to propagate and manufacture toxins, are not affected by the extirpation of diseased tonsils at the primary focus. Such an operation therefore cannot of itself cure a toxemia or a systemic disease caused by these organisms. According to Barnhill,[32] after new foci have been once established, the elimina-

tion of the original source of the disease may have little effect on the severity and progress of the complication. In explaining failure to improve following the removal of one focus or more, Rosenow and Nickel[33] say the disease may have become thoroughly established so as to continue independently of a primary focus. When operation fails to cure the toxemia or systemic disease, Eusterman[34] believes that either the removal of demonstrable foci is incomplete, coexisting infections have been left intact, or extreme anatomic changes have been brought about as the result of long-standing systemic infection.

There is no question, of course, that tonsillectomy often is incomplete. But even after a perfect operation, tonsillar tissue may recur, infratonsillar lymphoid tissue may grow upward into the empty tonsillar fossae, and tags and remnants of adenoid vegetations may be found.[8-16] What is the explanation for this and for the existence of purely bacterial foci of infection in apparently normal tonsillar fossae,[30] in the nasopharynx[29] and in treated accessory nasal sinuses?[17-26] The explanation, I believe, lies in the fact that after the extirpation of infected tissue a bacterial focus of infection frequently remains. The germs that persist may, however, in time be overcome by the patient's defensive forces, which now no longer have to combat the microbes in the tissue that has been excised and that had protected these bacteria from the patient's bactericidins. Such a result probably occurs in a sufficient number of cases to create the impression that the removal of the focus of infection has been accomplished by the surgeon, especially when it has been aided by hygienic measures, as recommended by Billings.[35] Permanent improvement, however, seldom has occurred in my own patients without further medical aid.

THE REMOVAL OF A BACTERIAL FOCUS OF INFECTION.

Most of my patients do not recover until, in addition to the removal of accessible diseased tissue, their antibody production has been stimulated through the proper administration of a pathogen-selective vaccine.[36-41]

There is no question as to the unpopularity of vaccine therapy in this country. Of the 396 members of the Congress of Physicians and Surgeons, the 340 physicians of Michigan

cities, the 166 Indianapolis doctors and the 359 medical practitioners from New York and Brooklyn answering a questionnaire sent them by Hektoen and Irons,[42] not one used any form of vaccine in focal infection. Among these are included the members of the American Laryngological Association. Many textbooks and encyclopedic articles on the nose and throat make no mention of vaccinotherapy. Others merely condemn it. Some favor its use only in acute conditions. In their published articles most otolaryngologists either completely ignore the subject or comment on it unfavorably, although a few nose and throat specialists, internists and bacteriologists speak more or less encouragingly of its benefits in chronic infection of the upper air passages.

This preponderantly adverse attitude is doubtless based upon disappointing experiences, probably in many instances with vaccines that lacked potency, that did not contain the infecting organisms or that were improperly prepared or improperly administered, an opinion shared by Coates.[46,47] Rosenow and Nickel[33] believe that the general disrepute into which vaccine therapy has unfortunately fallen is partly due to the narrow limits of effective dosage. Hicks[50] is convinced that many of the failures of vaccine therapy have been due to lack of appreciation of the extreme variability in the sensitiveness of the individual to his vaccine. Freiberg and Dorst[57] believe that it is primarily due to a failure to recognize the importance of the specificity of the antigen and the desensitization method of administration.

Some of the unpopularity of vaccinotherapy may be accounted for by failure of many clinicians to recognize that acute febrile conditions require very different treatment from subacute and chronic conditions, according to Crowe,[58] who regards the latter as a commonplace of vaccine therapy. Autogenous vaccine, as commonly made and administered, in my opinion, is likely to prove disappointing.

Specific antibody production is stimulated only by proper doses, properly spaced, of a vaccine containing all the required specific antigens. Fleming[59] states that appropriate doses of vaccine favor the killing of bacteria by the whole blood through increasing the opsonic power of the serum and

also through inducing leukocytosis. Heist, Solomon Solis-Cohen and himself[60] showed that in rabbits the process of immunization against pneumococci is paralleled by an increase in the bactericidal properties of the blood, the bactericidal reaction being specific to type. The production of antitoxin through increasing injections of toxin is shown not only in active immunization against diphtheria and scarlet fever, but also in the commercial manufacture of antitoxin.

CHRONIC UPPER RESPIRATORY CONDITIONS IN WHICH VACCINE THERAPY IS INDICATED.

Chronic infections are those generally regarded as best adapted for vaccinotherapy. They and focal infections are the only conditions that will be considered in this discussion. The giving of vaccine to protect a healthy individual, or to cure an acute infection, present entirely different problems and are definitely excluded from consideration.

Local treatment of the nose, throat and ear, and the removal of diseased tissue from them may be supplemented by injections of a potent vaccine for the purpose of stimulating the production of antibodies, which will destroy the invading germs and render their poisons innocuous.

Vaccinotherapy therefore may be used to facilitate the cure of a chronic infection of the upper air passages. Daland[44] states that a healthy young adult, whose tonsil has been affected for a few years, usually makes a rapid recovery after tonsillectomy without a vaccine, although he thinks a vaccine would accelerate recovery. He finds vaccinotherapy especially valuable after tonsillectomy in those advanced in years, debilitated, anemic, emaciated or suffering from complications. Similarly Hays[49] frequently administers a vaccine made from tonsillar cultures to adults, but seldom employs it in children. Hicks,[50] on the contrary, thinks success is more likely with young people than with old. Barlow[61] finds that infections of mucous membranes, such as recurring colds, chronic laryngitis, chronic otitis media, chronic bronchitis and bronchitic asthma respond well to vaccine therapy. He states that where operation is required for sinus infection, vaccines will assist in clearing the trouble more rapidly. He believes that recurrence of polypi would be less frequent if vaccine were more commonly employed. Dan McKenzie[55] often obtained benefit

from vaccine in nasal catarrh and sometimes in the convalescent stage of multiple sinusitis and pansinusitis. Hays[49] employs autogenous vaccines in chronic purulent otitis media, chronic inflammations of the nasal mucosa, atrophic rhinitis and atrophic nasopharyngitis. From a summary of his own cases and those of 17 other authors, Dabney[43] concludes that proof is not wanting to show that in acute and subacute otitis media, stubborn, slowly healing sinuses following mastoid operation, all forms of tonsillar infection, and furuncles of the auditory canals, vaccine, supplementing other therapy, will surely abbreviate convalescence. He believes this tends to prevent the familiar consequences of long suppuration in the ear, such as deafness, great inconvenience, loss of time at work, expense, and even death. Levy's[53] observation and experience led him to conclude that all obstinate cases in which the older methods have failed should receive the benefit of vaccine. This refers to all cases of aural disease, whether chronic or acute, with or without mastoid involvement, and all cases of accessory sinus disease. Fenton[48] reported clinical cures in a large percentage of chronic nose and ear cases which had failed to respond to surgical measures, which had already been operated upon to excess without relief, or which, for systemic reasons, were unfit for surgery. In Coates'[46,47] hands an appropriate potent vaccine proved efficacious in recurring furunculosis of the nose and ear, in acute rhinitis, in repeated acute colds and to a lesser degree in chronic rhinitis and in recurrent acute catarrhal and suppurative otitis media. It usually hastened the cure in sinusitis, when free drainage had been established. In chronic suppurative otitis Coates always gives vaccine a fair trial before radical operation, except where very distinct contraindications exist. He says that vaccine many times has put a definite check to a slowly progressive mastoiditis or has been the determining factor toward resolution in one that was at a standstill. In all cases after operation he deems it wise to employ a vaccine made from the pus recovered from the mastoid at operation and finds healing more prompt by its use.

With the careful administration of pathogen-selective vaccines I have cured many cases of chronic sinusitis that had failed to respond to local and operative treatment in the hands of expert otolaryngologists. In other instances I have been able by this means to aid the otolaryngologist in effecting

or hastening a cure. There have been several patients who, owing to the condition of the mucous membrane, were regarded by the otolaryngologist as unsuitable at the time for either operative or local treatment and for whom a preliminary course of pathogen-selective vaccine was recommended, a measure which of itself brought about a cure of the sinusitis, so that subsequent nasal treatment, either operative or local, was not required. Ordinarily, however, as Horder and Matthews[51] and others emphasize, the employment of vaccine should not be allowed to interfere with any other recognized and helpful method of treatment. In fact, as is well recognized, vaccine treatment may prove distinctly harmful in the presence of diseased tonsils and especially of a non-draining infected sinus.

By means of pathogen-selective vaccine I also have been able to cure cases of chronic aural discharge that for years had resisted treatment by skilled otologists. Inasmuch as my offers to make and administer pathogen-selective vaccines in hospital ward cases with suppurative otitis media and with mastoiditis both before and after operation were usually declined by the aural surgeons in charge, I have no results to report, although I believe that in such conditions a pathogen-selective vaccine is indicated.

In the prevention of the "common cold," both successes and failures have been reported from the use of vaccines. I believe that the term "common cold" is used to designate two quite different conditions having similar manifestations. The real "common cold" of unknown origin attacks an uninfected individual who is not harboring in his respiratory tract the germs of this disease. Consequently in its prevention an autogenous vaccine not only is not indicated, but may be even less efficacious than a stock vaccine. The designation, "common cold," however, undoubtedly includes cases of chronic infection of the upper air passages—sometimes purely bacterial, which are more or less quiescent when the patient's resistance is high and subject to exacerbations when resistance is temporarily lowered. In these cases I believe a pathogen-selective vaccine to be definitely indicated. By means of it I have in many instances succeeded in raising resistance to the infecting organisms and thus have prevented the periodical flares-up that give the appearance of repeated colds.

Barlow[61] and Coates[47] both found that repeated colds in a great majority of cases could be abolished or greatly reduced in frequency and intensity by autogenous vaccine. In Coakley's[21] hands autogenous vaccines have occasionally proved effective when other treatment had failed, in other instances they apparently had no influence on colds and in some cases they apparently made the colds worse.

Some ten years ago I employed the term "lingering influenza"[62] to designate cases of influenza or acute respiratory infection or so-called grip, complicated at times with pneumonia, which proved resistant to ordinary treatment, whose convalescence was unduly protracted, which ran a prolonged, subacute or chronic course, or which merged into a persistent toxemia. These cases are usually associated with focal infection. The temperature may remain slightly elevated or may be subnormal. Symptoms of toxemia are always present. Frequently there are signs of a chronic upper respiratory infection. An irritating and sometimes paroxysmal cough that resists all treatment often is present. Hemorrhage from the nose, lungs or uterus is not uncommon. "Lingering influenza" bears some resemblance to the cases of long continued, low grade, idiopathic fever, described recently by Kintner and Rowntree[63] to the grippal infections reported by Andrews,[64] and especially to the cases commonly observed by George W. Mackenzie,[65] in which the "grippe" takes hold of an apparently well individual and leaves him with a chronic ailment, whose real cause is focal infection. According to Mackenzie, the "grippe" (influenza) merely causes a lowering in the patient's resistance and uses up that remnant of resistance which had been keeping the patient going symptom-free before the attack of the "flu." Most of the cases of "lingering influenza" in my experience do not recover until given a pathogen-selective vaccine, whose administration often must be accompanied, preceded or followed by expert local or operative treatment of any infected foci.

When an indicated operation on the throat or nose is attended with danger, owing to greatly lowered resistance, the careful preoperative administration of a pathogen-selective vaccine may raise the resistance sufficiently to combat massive autoinoculation during the operation, promote healing and prevent postoperative complications. Hoover[66] says the dan-

ger of wholesale removal of foci when the patient is not in proper condition cannot be overemphasized, as this may so disseminate the infection and lower the patient's resistance that he will never improve. He thinks even badly infected tonsils should not be removed when the patient's condition is not good, but the operation should be postponed until immunity has been increased by treatment to the point that the tonsils can be removed without danger. Daland[44] believes vaccinotherapy may be of value by increasing the resistance of a patient who is a bad surgical risk and who requires a tonsillectomy. According to Horder and Matthews'[51] experiments and experience, it is probable that patients who are about to be operated upon and who are subjects of subinfection by cocci, especially when the subinfection involves the area of operation, have something to gain by preventive inoculation. These authors find it difficult to understand why this field of therapeutics at present is so little cultivated. Hays[49] speaks of cases in which it would be advisable to administer vaccine to rid the system of as much infection as possible before removing tonsils. In Coates'[47] opinion, if vaccine is given before operation in sinusitis and in chronic suppurative otitis media and in mastoiditis and its complications, the individual's immunity will be so raised that cure is hastened.

Before permitting an operation upon a patient with evident markedly lowered resistance I always administer several doses of a pathogen-selective vaccine. In fact, Dr. Robert F. Ridpath frequently has refused to operate on the nose and throat of my patients until after they have received a partial course of pathogen-selective vaccine. I wonder whether such a precaution does not greatly diminish the incidence of pulmonary suppuration and other complications.

The greatest need for preoperative vaccinotherapy in my opinion is in those cases of arthritis, endocarditis and other systemic diseases, due to a primary focus in the upper air passages, where operation is feared, lest the organisms entering the wound cause an exacerbation of the systemic disease. In such cases many internists advise against the removal of diseased tonsils rather than run the risk of making the patient worse. Yet, does not their retention destroy all hope of a complete cure? If by means of a pathogen-selective vaccine the patient's blood were rendered bactericidal to the infecting germs, might not the blood then be able to kill off

any organisms that enter through the open wound and gain access to the circulation? Similarly the soluble exogenous toxins present in such a vaccine might stimulate the production of sufficient antitoxin to neutralize the excess of toxin that would be absorbed into the system from the operative site. Burbank and Christensen[67] also feel that tonsils should rarely be removed in an active case of arthritis until that patient has had a series of vaccine injections to ward off the possibility of the acute exacerbation that may follow a tonsillectomy. They resume the injections two weeks after the operation. They believe that other deep-seated, active foci should also be treated in the same conservative manner. It might be mentioned in this connection that preoperative vaccinotherapy has been used with success in other branches of surgery.

Some authors would use vaccines in place of operative measures which are too dangerous. Crowe,[68] for instance, in reference to rheumatism, believes that in adults especially the removal of tonsils should always be approached with the very greatest caution. It may take months, he says, to get over the operation, during which time the rheumatic symptoms may steadily progress. If we are dealing with a severe acute endocarditis or nephritis, or if there are certain contraindications to operation, Hays[49] likewise thinks we should try the most conservative procedure first.

A condition in which I have found pathogen-selective vaccine of value is mixed infection in pulmonary tuberculosis,[69] which in many cases I regard as a combination of tuberculosis of the lungs with chronic pyogenic infection of the upper respiratory tract. In addition to the measures usually employed in tuberculosis, I frequently administer tuberculin, to raise the patient's resistance to the tubercle bacillus, and a vaccine made from pathogen-selective cultures of the nares, tonsils or tonsillar fossae, nasopharynx and sputum, to raise his resistance to the other infecting organisms. Barlow[61] states that it is fairly well recognized that tuberculin has a definite value, but that it is worth remembering that secondary infection of tuberculous lesions can often be lessened by the use of autogenous vaccines. Dudgeon[45] says that treatment of cases of pulmonary tuberculosis falls into two main groups: *1*. Those who are to be treated with a tuberculin preparation only; *2*. Those who are also to be treated for superadded mixed

infections. For cases of the second group he prepares autogenous vaccines of the streptococci, pneumococci or other pyogenic bacteria from the sputum.

When a chronic infection of the upper air passages is producing a general toxemia or is causing disease in distant tissues and organs, I regard the need for a vaccine properly prepared and properly administered as definite and urgent. In a toxemia the fact that the infecting bacteria are able unmolested to produce toxins, which the patient is unable to manufacture sufficient antitoxin to neutralize, indicates a great need for some means of stimulating and increasing antibody production. The occurrence moreover of systemic disease due to focal infection proves the absence from the patient's blood of sufficient antitoxin or of sufficient bactericidal substances against the infecting organisms, which consequently are able to travel unharmed in the blood long enough to reach distant tissues and organs, and to establish there secondary foci. The physician, whatever his specialty, recognizing a focal infection, too often thinks he has checked the flow of germs and toxins when he has an otolaryngologist supposedly eradicate the infected focus. But, as already has been shown, the removal of diseased tissue or the opening and drainage of an infected cavity—which most physicians regard as the elimination of the focus of infection—does not get rid of the infecting germs, which often persist at or near the operative site, where they continue to elaborate their poisons. Even were it possible to remove all infecting germs from the primary focus, the germs at the secondary foci would still remain, propagating and manufacturing poisons. The proper administration, however, of a properly prepared vaccine, containing both the bodies of the infecting germs with their endogenous toxins and also the soluble exogenous toxins, will stimulate in the patient's tissues the production both of bactericidal substances to kill the infecting bacteria and of antitoxins to combat their toxic products.

I employ pathogen-selective vaccines with considerable success in all cases of toxemia and of disease due to focal infection. The latter includes not only systemic diseases, such as arthritis, endocarditis, asthma, bronchitis, nephritis, pyuria and various nervous disorders, but also skin diseases, such as acne, eczema, pruritis and dermatitis, and certain diseases of the eye, etc.

REQUIREMENTS FOR AN EFFECTIVE AUTOGENOUS VACCINE IN CHRONIC AND FOCAL INFECTIONS.

There is room for little more than a brief general summary of the many requirements for effective vaccinotherapy in chronic and focal infections.

A vaccine, to stimulate the production of the required specific antibodies, must contain all the infecting organisms, together with their soluble exotoxins. In a subacute, chronic or focal infection, however, the mere presence or even the predominance of a microbe in a culture from an infected area or from infected material is no proof of that germ's infectivity and no evidence of any relationship between that organism and any existing systemic disease. In 384 cultures in Rosenow's brain-broth, made for me by Boerner, 169 (44 per cent) of the predominating organisms were not even pathogenic for the patient. Yet Bergey,[70] Hays[49] and innumerable others make their vaccines in chronic cases from the prevailing bacteria.

Some bacteriologists include only streptococci, although Boerner and I,[41] in a study of 404 pathogen-selective cultures, found that a large percentage of streptococci are non-pathogenic for their host. Lowe's[71] percentage was even higher than ours.

A number of investigators apply what they regard as selective tests to the organisms obtained on ordinary culture in an endeavor to pick out the causal one. In view of the fact, however, that the infecting organism failed to grow up in 11 per cent of the 404 cultures in Rosenow's brain-broth reported by Boerner and me,[41] and in 18 per cent of the 600 cultures reported by Lowe,[72] even a selective test that is 100 per cent perfect would fail to obtain the etiologic organisms in from 11 to 18 per cent of the cases, if applied only to bacteria that grow up on culture media other than the patient's own fresh, whole, coagulable blood. Moreover, the various serological tests, except for special conditions, are regarded by Lowe[71] as either too elaborate or too indefinite to be applied as routine tests in clinical bacteriological examinations.

Precipitin reactions have been employed by some, but Bürgers and Wolffheim[73] regard them as unsuitable for the purpose.

Agglutination tests are deemed of great theoretical and practical importance by Cecil,[74] Dawson, Olmstead and Boots,[75] and others, but the work of Chapman, Rawls and Berens[76] would indicate that agglutination is probably independent of toxicity.

The complement fixation test is employed regularly by Hadjopoulos and Burbank,[77] and Burbank and Christensen,[68] and is regarded by Kolmer[78] as sometimes of value, but has not proved reliable in the hands of Crowe,[79] and Chapman, Berens, Lieb and Rawls.[80] Amoss[81] states that pyogenic cocci are only feebly productive of complement fixing bodies, while Cecil[82] says that the streptococcus complement fixation test is an extremely elaborate and difficult procedure, and that bacteriologists do not consider it particularly reliable in distinguishing various types of streptococci.

Intracutaneous testing with the soluble exotoxin, or with a bacterial emulsion, of each germ that grows on culture is employed by many. Keilty,[83] Eiman,[84] Freiberg and Dorst,[57] Cox,[85] and others believe that by it one can determine susceptibility to a given bacterial species. On the other hand, Bürgers and Wolffheim,[73] Gay,[86] Swift,[87] Mackenzie and Hanger,[88] Moore,[89] Kolmer and Boerner,[40] and I[90] have questioned its reliability.

Animal passage, as employed by Rosenow and his associates and some others, not only is too elaborate for clinical use, but the greater number of workers have been unable to verify Rosenow's findings.

Wood[91] thus presents the dilemma confronting the otolaryngologist:

"How can the average man tell when an apparently normal sinus contains a vicious type of infection? Cultures do not help much. Injection into animals is almost as useless because a microorganism to which one species is naturally immune may kill another species. Even in different individuals of the same species, one strain of bacteria may grow and thrive as a harmless parasite to one host, but when transmitted to another may prove fatal. No matter what biological characteristics the cultures may show, how can one

determine when they are virulent for the particular individual if they do not show evidence of local inflammation in the area which they have selected as their abode? What is needed is real tangible evidence that can be applied as a useful aid in diagnosis."

I believe that such a useful diagnostic aid in chronic and focal infections is supplied by the pathogen-selective culture,[36-41] which aims to furnish a simple means for selecting the etiologically important organisms from a mixed culture. It is based on the assumption that organisms capable of growing in the fresh, whole, coagulable blood of the patient are those which are most pathogenic for that individual. This assumption followed the discovery that the whole blood of animals naturally resistant or immune to pneumococci[59] and to meningococci[92] is bactericidal for such organisms, while the blood of animals naturally susceptible to them lacks this bactericidal property, which observations have been confirmed in regard to pneumococci.[93,94,95] Kolmer and Boerner,[40] who state that the pathogen-selective method may be helpful in selecting bacteria for vaccines in mixed infections on the basis that only those capable of growing in the whole coagulable blood of the patient are apt to be virulent, mention the possibility that an organism unable to grow in the blood or produce septicemia may still be able to produce local infection. Similarly Lowe,[72] who in over 600 examinations by this method confirmed my opinions concerning it, regards it as applicable to the bacteriological examination only of cases in which some focal infection is causal of a systemic infection. Both he and Shearman,[96] who investigated a series of 150 cases by this method with similar results, made a number of control tests, which demonstrated the reliability of the method. They also improved the technic. Boerner and I,[41] from an analysis of 404 pathogen-selective cultures, believe they provide a basis for selecting the organism to predominate in an autogenous vaccine. Barlow,[61] Beckley,[97] Clark,[98] Crowe,[79], Geckeler and Vischer,[99] Graham,[100], Lowy,[101] Thompson and Hill,[102], Vischer[103] and Walls[104] have also published favorable reports on the method. Amoss,[51] however, is of the opinion that, as the blood of normal persons contains small amounts of bacteriolysins for many bacteria, tests to show the bactericidal power of the blood have little clinical application.

THE PATHOGEN-SELECTIVE CULTURE AND VACCINE.

In taking the pathogen-selective culture, two tubes are employed, one containing a rich culture medium, such as Rosenow's brain-broth, the other sterile and empty, except for a few drops of this same medium. A sterile swab is applied to the part or substance to be cultured, then rubbed on the bottom of the empty test tube and then inserted into the brain-broth tube. Three to 5 cc. of the patient's fresh, whole, unchanged and untreated blood, obtained from a vein, are then placed in the inoculated empty tube. Both tubes are incubated for 24 hours and then are plated. The organisms that grow up are identified and grown separately in brain-broth for several days. A vaccine is then prepared, consisting of nine parts of the culture medium containing the organisms that grew up in the patient's blood and one part of the culture medium containing the organisms that failed to grow in the patient's blood. The details are given in Kolmer and Boerner's "Approved Laboratory Technic."[105]. The vaccine thus contains both the endogenous toxins contained in the bodies of the bacteria and the soluble exogenous toxins produced in their growth.

In an effort to include in the vaccine all the infecting organisms, I make pathogen-selective cultures simultaneously of all possible foci. Thus I always culture the nares (or certain sinuses), the tonsils (or the tonsillar fossae) and the nasopharynx, culturing also pus from the ear or from a furuncle, when present, an extracted tooth, the urine in urological conditions, the prostatic secretion in genitourinary diseases and frequently in arthritis, and the feces in some intestinal conditions and in many cases of arthritis.

THE ADMINISTRATION OF A POTENT VACCINE.

A critical review of the various methods of giving vaccine would be too long for this present article. Instead I shall merely refer briefly to my own method of administering the pathogen-selective vaccine. This vaccine is so very potent and the patient's resistance or susceptibility or hypersensitiveness to the infecting organism or its toxins varies so greatly, it is necessary to study and treat each patient individually. For instance, after two months' treatment the appropriate dose for the individual patient may be anywhere between 2

cc. of the vaccine, containing two billion organisms, and one quintillionth of a cc. At the present moment probably half of my patients are receiving less than one-billionth of a cc. There consequently can be no rule of thumb nor any dosage scheme decided upon in advance.

Before giving the initial therapeutic dose I make three simultaneous intracutaneous tests with 0.05 cc. of the diluted vaccine, frequently containing, respectively, 10,000 organisms, one organism and the equivalent of one ten-thousandth of an organism. The initial therapeutic dose is based upon the reactions produced by these intracutaneous tests. This is similar to the method I have been using for many years in determining the initial dose in tuberculin therapy.[106,107] All subsequent doses of vaccine are based upon the general, focal and local reactions to the immediately preceding dose, just as are my tuberculin dosages.[108] This requires familiarity with all the different subjective and objective manifestations of what I term the favorable and the unfavorable reactions as well as ability to recognize their occurrence. Twenty years ago I listed 98 such symptoms of tuberculin reactions that I had personally observed and added 28 additional symptoms reported by others.[109]

I regard as the appropriate dose one which produces a favorable reaction or a very slight unfavorable reaction. The former is always repeated until it no longer causes a favorable reaction, when it is slightly increased. The dose that produces a slight unfavorable reaction is either repeated or slightly reduced, never increased. A dose that is followed by a moderate or marked unfavorable reaction is always reduced to from one-tenth to one-billionth of the preceding dose.

A dose that produces a favorable reaction should be repeated just before the good effect begins to wear off. Five to seven days is the usual interval. After a moderate or marked unfavorable reaction it is well to wait ten to fourteen days or longer before giving another dose, certainly until several days after all symptoms of the unfavorable reaction have disappeared.

The duration of the treatment depends upon the individual case. Very occasionally a patient is cured with six to eight doses. When a patient has been without symptoms for a

month or more I begin to increase the interval to two or three weeks, then to one and two months, after which all vaccine is suspended, unless subsequently the symptoms return, whereupon a few more doses are given. If a patient is not completely cured when several doses of two billion germs have been given and no previously unrecognized focus is discovered, I usually make new pathogen-selective cultures and give another course of vaccine. Some patients require an injection every few weeks or months over a period of years in order to remain well.

SUMMARY AND CONCLUSIONS.

1. Chronic infection of the upper air passages may manifest itself as a local inflammation, as a general toxemia and as a systemic disease, the focal origin of the last two being unrecognized in most instances.

2. The otolaryngologist frequently fails to cure or remove the focus of infection because his attention is directed to the removing of infected tissue and the washing-out and drainage of infected cavities rather than to the overcoming of the infecting bacteria and their toxins, which persist after treatment and operation.

3. The bacteria and their toxic products are combated only by the patient's resistive forces, which may be aided by hygienic measures and stimulated through the proper administration of a potent vaccine.

4. Vaccine therapy is condemned or ignored by most physicians, although a few speak more or less encouragingly of its beneficial effects in chronic infections of the upper air passages.

5. Specific antibody production is best stimulated by optimum doses at optimum intervals of a vaccine containing all the required antigens.

6. Appropriate vaccine therapy is indicated to supplement the local or operative treatment: in chronic infection of the upper air passages; in the type of so-called "common cold" which is a chronic sinusitis with alternating periods of activity and latency; in "lingering influenza"; as a prophylactic preoperative measure in patients with markedly lowered re-

sistance and especially in the presence of severe arthritis, endocarditis and certain other systemic diseases; in the mixed infection of pulmonary tuberculosis; and in chronic toxemia and systemic disease secondary to focal infection in the upper respiratory tract.

7. In a subacute or chronic infection the mere presence or even the predominance of a microbe in a culture from an infected area or from infected material is no proof of the infectivity of such germ and no evidence of any etiological relationship between it and any existing systemic disease.

8. Of the various methods employed to pick out the etiologically important organisms from a mixed culture the pathogen-selective culture is regarded by the writer as the simplest, the most easily available and the most reliable.

9. The pathogen-selective vaccine, when made from cultures taken from all suspected foci, contains both the endotoxins and the soluble exogenous toxins of the infecting organisms.

10. This vaccine is usually very potent and must be administered with the greatest care.

11. Individual hypersensitiveness to the toxins of the infecting bacteria contained in the pathogen-selective vaccine varies to such an extent that the optimum dose may be one cc. (containing one billion germs) in one patient and a quintillionth of a cc. in another patient.

12. The initial dose is based upon the reactions to graduated intracutaneous tests.

13. Each subsequent dose is determined from the general, focal and local reactions to the immediately preceding dose.

14. The duration of treatment depends upon the individual case.

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TUBERCULOSIS OF THE LARYNX.*

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As is widely known, tuberculosis of the larynx is the most frequent complication of tuberculosis of the lungs. Hippocrates already knew of phthisis of the larynx, but probably also noticed its connection with consumption, a discovery which we only find again with Galen and which thenceforth remained buried for more than 15 centuries, until its revival by Louis and Laennec. The first successful descriptions of the pathological changes of the larynx we find in Morgagni's (1682-1772) famous book, "De sedibus et causis morborum per anatomen indagatis." Louis and Laennec drew special attention to the causal relation between laryngeal diseases and the lungs. In 1821, Sachse was the first one to recommend the opening of the tubercularly diseased larynx, while Trousseau and Bellocq were the first to report (1827) experiments of local treatment of the larynx by painting and injecting with solutions of nitrate of silver. Through the invention of the laryngoscope in 1858 by the Spanish singer, Manuel Garcia, and its introduction into medical practice by Ludwig Türk and Johann Nepomuk Czermak, a new era of local therapy of laryngeal diseases had begun. At the same time, Virchow ascertained the tubercular character of phthisis of the larynx histologically.

The frequency of tuberculosis of the larynx varies according to different authors, depending on whether the findings were made in the dissecting room of a hospital for tuberculosis or at a laryngological clinic; the figures fluctuate from 36 per cent to 97 per cent. It may be assumed, however, that intra vitam tubercular changes in the larynx are found in from 25 per cent to 30 per cent of consumptives, while more than 50 per cent of laryngeal tuberculosis is found on the dissecting table. Laryngeal tuberculosis very seldom appears before the tenth year. It is most frequent between

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the years of 20 and 40. Women reach the highest percentage during the third decade, assuredly because of the highest number of births during those years, which may in any case lead to a reactivation of a process which up to then was latent in the lung or larynx. Men are more often subject to laryngeal tuberculosis than women, but there is no considerable difference between the sexes. The occupation (working in the open under wet or dusty conditions), of course, plays a great part.

Whether alcohol and tobacco affect the development of phthisis of the larynx has not been proven. V. Tovolgyi has experimented with 4,622 patients; among them 679, or 19 per cent out of 3,395 tuberculous smokers, and 211, or 13 per cent of 1,227 non-smokers, suffered from an incipient or fully developed laryngeal tuberculosis. The difference is evidently quite unimportant. Among the smokers, 742, or 21 per cent, had an unspecific laryngitis, while 201, or 6 per cent, were free from it. One could conclude therefrom that even the unspecific chronic catarrh does not indicate a special predisposition for laryngeal tuberculosis. This conclusion is not entirely unjustified, inasmuch as the smoker as well as the victim of an unspecific catarrh disposes of the bacilliferous sputum by repeated clearing of the throat and thus prevents the entrance of the tubercle bacilli into the mucous membrane. The strong susceptibility of the sufferer from dry catarrh of the mucous membrane to laryngeal tuberculosis is explained by the fact that the sputum sticks to the dry mucous membrane of the larynx and is not always loosened even by a stronger cough. The mucous membrane, which is provided with numerous fissures and excoriations, may furthermore facilitate the entrance of the bacilli.

That a heavy strain on the voice does not lead to laryngeal tuberculosis is proven by rare appearance of this disease among professional singers. Some authors (Thausing, and Lohfeld) even go as far as to see the best prevention of laryngeal tuberculosis, and even of the development of tuberculosis of the lungs, in intensive vocal exercises. As to frequency, the back wall of the larynx is struck first, then the vocal cords, the epiglottis and the arytenoid region.

The question of the origin of laryngeal tuberculosis is still a matter of dispute among scientists. Primary laryngeal

tuberculosis at least is so rare that it is of no practical importance. Even though there may be cases where the laryngeal disease is recognized as being tuberculous, and the accompanying tuberculosis of the lung appears clinically only later, one must still not speak of a primary laryngeal tuberculosis in such cases in the anatomical sense. There are three ways in which tubercle bacilli can enter the larynx from the lung:

1. Through infection by direct contact with sputum. *2.* Hematogenically. 3. Lymphogenically.

The two latter ways we cannot exclude with certainty, but at least they are the exceptions. An infection of the larynx through the surface of the mucous membrane seems the greater possibility. The question why the tubercle bacilli prefer to strike the larynx especially and the interarytenoid region and the vocal cords before the rest of the upper air and food passages is of great interest. It is possible that small wounds develop in the mucous membrane through coughing and hawking, and that the mucous membrane is loosened by the macerating effect of the sputum and this facilitates the penetration of the bacilli, which are pressed into the tissue through closing the glottis. On the other hand, we observe even on the back wall of the larynx, which is subject to numerous harmful influences, a thickening of the epithelium, which may even develop to the so-called pachydermia, and which should rather offer an increased protection for the tissues which are lying behind it. Breaks on the mucous membrane of the lips, tongue and cheeks occur more frequently, since these regions are exposed to a greater degree to attacks from the teeth and the act of chewing. And yet only very seldom do we observe tubercular changes of the membranes of the tongue or lips compared with the number of cases of tuberculosis of the larynx. Considering the masses of tubercle bacteria in the upper food and air passages, which is the rule in open tuberculosis of the lung, it is possible for the tubercle bacilli to pass through the mucous membrane at any point. They can even enter through the intact mucous membrane. Therefore, the observation of rough mechanical lesions alone cannot supply a sufficient explanation to the etiology of the tuberculosis of the larynx.

There are two other factors which we must consider intensively:

1. The tissues of the larynx offer more favorable conditions for the settling of the tubercle bacilli than other parts of the upper air passages, namely, through the particular arrangement of the lymphatic vessel system. The middle part of the larynx is only sparingly equipped with lymphatic vessels, while the subglottic part and particularly the aryepiglottic folds show a very extensive lymphatic vessel system (Most, Reinecke, Hajek, etc.). Slight tumors in the region of the laryngeal narrowness consequently cause metastasia of the lymphatic glands only when they transgress this region of the larynx upwardly or downwardly. In tuberculosis of the larynx there is only a very infrequent participation of the regionary lymphatic glands. According to experiments the mucous membranes of the vocal cords represent a closed lymphatic vessel system. But on the back wall of the larynx the mucous membrane is, as well, only slightly developed. The region of vocal lips and the back wall, therefore, offer unusually favorable conditions for the settling of tuberculosis, according to the theory of Tendeloo. He claims that the overwhelming predisposition of the paravertebral parts of the lungs toward tuberculosis is conditioned upon the insufficient kinetic energy of the lymphatic stream in this region.

Blumenfeld says: "The vocal lips and the plica interarytenoida represent a region of heightened local sensitivity for disease of the first localization of the secondary tuberculosis of the larynx, and this for the reason that they in themselves represent the region of a secluded lymphatic space, in which the kinetic energy of the lymphatic movement must be *a priori* assumed to be very small, an hypothesis, which is confirmed by the small participation of the regionary lymphatic glands during the illness of the parts under discussion. The low kinetic energy of the lymphatic stream is the condition for the settling and the effect of tuberculosis."

The difference of the lymphatic vessel system in the larynx of the child and the adult also explains the fact that the larynx of the latter is more frequently diseased than that of the former. Secondly, we must not forget that the conditions of immunity of the entire organism and also the local defensive powers of the organ play an important part in the development of the tuberculosis of the larynx. The origin and the development of phthisis of the larynx are in every case

a very important indicator of the actual immune-biological condition; they show us the phase of the battle between the body and the tubercle bacilli, or their poisons (Bumba). In advanced stages of exudative tuberculosis of the lung, in which the (immunizing) forces of the origin are wanting, we, of course, find a participation of the larynx more frequently than in mildly beginning diseases. In more than 90 per cent of all cases of tuberculosis of the larynx, the sputum contains tuberculosis bacilli. We principally find that phthisis of the larynx is associated with a productive and exudative cavernous tuberculosis of the lung. The assumption of Besold-Gidionsen that extensive tuberculosis is not essential in the pathogenesis of tuberculosis of the larynx does not seem credible, although the most serious cases of tuberculosis of the larynx are to be found with a minimal condition of consumption, and vice versa. If tuberculosis of the larynx starts on one side, it more frequently finds its origin on the corresponding side of the lung rather than on the opposite side. This observation, however, has not a rule and cannot be taken as proof for the lymphogenetic formation of tuberculosis of the larynx. Nevertheless, there are cases where simultaneous tuberculosis of the larynx and the lung are an expression of inferiority of this entire side of the respiratory organ (E. A. Mayer). An explanation of this collateral correspondence was also looked for in the fact that a person with a left cavernosis, for instance, is mostly struck first on the left half of the larynx, because of lying on the left side, an assumption which was supported among other things by the fact that in cows we find tuberculosis of the larynx most frequently on the front of the larynx, that is to say at the point where the bacilliferous sputum accumulates because of the posture of the animal. If several members of a family are struck simultaneously with tuberculosis of the larynx, or in case of an ascertained tuberculosis of the larynx in the grandparents or parents of a patient with laryngeal tuberculosis, the assumption of a certain hereditary predisposition may be justified.

PATHOLOGICAL ANATOMY.

The living substance responds to every damage done to its state of physiological life with a defense reaction at the spot of the irritating influence, namely, with an inflammation. To

the entrance of Koch's bacillus, the tissues react with an inflammation, as well, indeed with a "specific inflammation." In addition to this specific inflammation we also find, however, changes of a generally harmful nature in the tissues. As we know, the sum of the inflammatory defensive mechanism is composed of alterative, exudative and productive processes. Alteration finds expression in the intracellular changes which take place in the structure of the protoplasm and the nucleus; we observe fatty infiltration of the damaged cell and changes in the colloidal state (colloidal degeneration), and dropsical swellings or albuminous turbidity of the protoplasm develop. The highest alterative changes often lead to an acute necrosis of the diseased tissues. In addition to these alterative-degenerative changes, we find as an essential sign of inflammation the participation of the vessel apparatus: the exudation of liquid substance from the circulation into the tissues. This exudation starts with an inflammatory hyperemia of the toxically damaged vessels, an increase in the rapidity of the current and the pressure of the blood, which soon leads to the permeation of liquid parts of the blood. The liquid exudate mixes with toxic material and such material as has escaped from cells and liquefied intercellular substances. The serous exudation is followed closely by the emigration of leukocytes; only later do we also notice an emigration of the erythrocytes, the blood plates and the lymphocytes. In the exudate these cells may continue to multiply and to change. The exudate also frequently contains exfoliated and broken down tissue cells and descendants of fixed tissue cells, which are processes, that lead to a productive inflammation. Each process of inflammation originates, therefore, in the combined action of alterative, exudative and productive tissue reactions. Thus the specific irritation response of the tissues is also a combined defense reaction. In the pathological anatomy of tuberculosis of the larynx, we frequently observe, however, in the acute beginning of the disease a purely exudative tissue reaction, but we do not in the great majority of cases fail to see a productive component. Despite this co-operation of the defensive powers, the degrees in which the different reactions participate in the building of the nosological tissue varies greatly (in each case). Only thus are we enabled to recognize the exudative or productive character present in a change of tissue.

The conditions for the preponderance of exudative or of productive activity are not as yet completely ascertained. They are, however, dependent on the immuno-biological condition of the organism, on the virulence of the virus and also on the local structure of the tissue. The organism always reacts exudatively when a highly virulent infection intensely calls for a defensive reaction, so that no proliferation of the tissues is possible, for this requires a certain time for its development. It is also evident that the structure of the organ influences the histological picture. The exudative inflammation will manifest itself differently in the tightly strung tissue of the laryngeal mucous membrane than for example in the lung, where preformed cavities are ready to accommodate the exudate. The nature of the specific reaction of the tissues, that is to say of the exudative and productive activity, is evidenced by an analysis of the structure zone of the specific tissue-production, of which the irritation response of the organism is composed. The exudative reaction of the tissues is characterized by the transudation of an exudate from the blood stream into the tissues. In the larynx we find the exudation into the interstitial spaces, where it cannot at first be distinguished from an unspecific inflammatory reaction if the productive elements are lacking. We will, consequently, have to look out for a various loosening of the tissues, for edematous saturation, for coarsely or finely reticulated or intracellular edemata, for leukocytic infiltration, that is to say, for seemingly unspecific processes. Proof that there is a question of tubercular changes in the etiological sense can hereby be made through the bacilli test or through the accompanying appearance of histologically specific elements. The exudate can differ greatly, according to its constituent elements. From the purely serous exudate, with more or less fibrin, there are all gradations from the inflammatory edema to those forms rich in cells or composed almost exclusively of cells. Only in extremely rare cases can a *restitutio ad integrum* be developed through the reabsorption of the exudate. Smaller exudative parts of tissues do not infrequently develop into a specific or unspecific carnification. From the edges of the diseased tissues there is a proliferation of granulation tissue into the exudate; the exudate is being organized. These processes already present a transition to the second fundamental reaction of the body against the tuberculous infection—to the productive irritation response of the tissue.

The productive process is characterized by a proliferation of the fixed tissue cells at the spot of the irritation. The specific productive tissue element is the tubercle, which is itself characterized by the appearance of epitheloid and giant cells. The epitheloid cell is evident in the histological examination of the tubercle through the pale stain of the protoplasmic body. The relatively large cells are most often closely pressed together—therefore polygonically configurated—hence the name epitheloid cells, and possess a vesicular like nucleus (which is hard to stain), and which contains from one to three nucleoli. At the lymphocytic marginal zone of the tubercle the epitheloid cells are not difficult to recognize because of their rich quantity of plasma and the pale hemotoxyline stain. The epitheloid cell originates from connective tissue; its matrix must be looked for in the fixed cells of connective tissue, the fibrocytes and the vessel endothelia. From them by mitosis the epitheloid cells develop. They pile themselves in a concentric stratification, whereby a fine reticulum penetrates the tuberculous growth and surrounds it. Just as the epitheloid cells, the giant cells must be regarded as typical of tuberculous granulation tissue. But giant cells are also found in lues, as a reaction of a foreign body, and in certain tumors. One distinguishes between the young giant cells and the full grown forms of Langhans. The former develop through fusion of several epitheloid cells and look like large epitheloid cells with one to three nuclei. The forms of Langhans are exceptionally large and show a protoplasm of apparently homogeneous reddish stain; furthermore, they show a corona of marginal, often very numerous nuclei, which occasionally join in narrow fusion, an observation, which indicates a quick amitotic division of the nuclei and thereby an increased metabolism of the cell. The formation of the giant cells is today universally regarded as an angioplastic metamorphosis. The primary result of the irritation of the organism is followed by secondary changes. Caseation and softening constitute the end of the exudative tissue reaction in the great majority of cases, while the productive part of the tissue is infiltrated by newly formed connective tissue, which later is enclosed by coarse, fibrous tissue and thus prevented from further growth. Besides this there are a number of other possibilities. The exudate can be reabsorbed or organized. The productive new growth can soften and break down because of nutritive disturbances and thus lead to the development of a cavity.

Smaller seats of caseation are often calcified and become fibrously encapsulated.

The clinical forms of tuberculosis of the larynx are divided as follows:

1. Infiltration (including miliary nodules on the surface). *2.* Ulceration. *3.* Perichondritis. *4.* Tumors.

1. Infiltration: In infiltration we find macroscopically the unmistakable signs of an inflammation: increased substance and reddening of the diseased tissue. At the back wall of the larynx we then notice either a lumpy or a flatter thickening, which more or less reaches into the lumen and may cause an impediment of the closure of the glottis. If the disease starts with the epiglottis, the latter has a puffy, plump appearance, while the vocal cords seem to be swollen to a spindle shape or are totally thickened. The yellow nodules, which appear in the submucous tissue, are also frequently macroscopically visible through the mucous membrane. The monolateral beginning of the disease is typical. Histologically the increase of substance is conditioned by the appearance of tubercles, or rather tuberculous granulation tissue of lymphocytic infiltration and inflammatory exudation. The first tubercles sprout in the close environment of the mucous membrane, the epithelium of which can be entirely intact in the stage of infiltration; they lie subepithelially. Through confluence of separate tubercles large areas of the disease develop and these give rise to the loosening of the submucosa, but have also an irritating influence on the epithelium. The tuberculous infiltration does not always show a nodulous structure; it is, on the contrary, frequently rather diffuse. The tuberculous infiltration progresses toward the surface as well as toward the depth and only the muscle layers of the submucosa often provide a certain resistance.

2. Ulceration: In the tubercular permeation of a tissue there may develop below the epithelium a melting down of the latter, which leads to an *ulcer*. The epithelial cells in the neighborhood of the tubercular new-growth also very soon show degenerative signs and colloidal degeneration, dropsical swelling, formation of vacuoles, etc. Lymphocytes and epithelioid cells proliferate into the epithelial tissue, gradually separate the cells from their combination and thus finally lead to

a necrosis of the epithelial coating. As soon as the epithelium of the preulcerous zone is completely destroyed, the tuberculous tissue lies on the surface and we have before us a tuberculous ulcer. As a rule the deep ulceration follows because of caseation and decay of the tuberculous tissue. At the bottom of these ulcerations we find finely grained, caseous matter which consists of cellular and nuclear remnants, and of anuclear cells and fibrin. Towards the healthy tissue the ulcer is usually demarked by a zone of fresh tubercular granulation tissue. The *productive* ulcer, therefore, develops through a proliferation of tuberculous tissue which leads to a pressure necrosis of the epithelial covering. In contrast with the above the exudative ulcer is always the product of a distintegration of tissue, of a necroticising inflammation. Macroscopically one finds the exudative ulcer in freshly inflamed loosened tissue. Microscopically, in the fresh stage, these ulcers show no sharp line of demarcation toward the healthy tissue. The leuko- and lymphocytes of the marginal zone always become rarer and finally lose themselves in the healthy tissue. Only the productive change, the sprouting of tuberculous tissue granulation offers resistance to the further disintegration of the tissue. Through further fibrous change a cicatrization of the ulcerated part may take place.

3. Perichondritis: Tuberculous perichondritis, which is found most frequently on the epiglottis and on the arytenoid cartilage, but which may also seize all the other cartilaginous parts of the upper air passages, is, as a rule, the consequence of a deeply seated ulcer in the mucous membrane; it may, however, also appear without ulcerative changes. In the beginning of its disease the perichondrium shows a prolific infiltration of round cells. Soon a formation of specific granulation tissue can be noticed, which absorbs the separate tissue elements; mucous glands, connective tissue, etc., are doomed to perish. The necrosis leads to the formation of a finely grained detritus, which frequently reaches to the cartilages; the cartilage which is dependent for its nutrition on the perichondrium shows high grade changes of interstitial and cellular nature before the entrance of the tuberculous tissue. In advanced cases softening and liquefaction of the cartilaginous substance may take place, which leads to stripe-like splitting of the latter. Thus cartilaginous sequestra develop, which segregate and are to be found mostly on the bottom

of the ulcer as small isolated cartilaginous pieces in the caseous substance or in the tuberculous granulation tissue. A proliferation of the granulation tissue into the cartilage may also develop. The lymphocytic infiltration reaches far into the cartilage. In existing ossification of the cartilage the tuberculous granulation tissue proliferates into the marrow of the bone and here leads to a necrosis with expulsion of sequestra, which may then under certain conditions appear in the sputum.

4. *Tuberculoma:* By tuberculoma we mean tumor-like products of tuberculosis which macroscopically give us the impression of tumors in contrast to diffusely tubercular infiltration.

With regard to the histological picture we distinguish two kinds of tuberculoma, those consisting of connective tissue, the fibrotuberculoma and those whose main constituent is composed of granulation tissue, the granulotuberculoma. The fibrotuberculomas are found almost exclusively on the back wall and on the vocal folds. They are mostly pedunculated (Manasse), but they may also be mounted on a broad basis. The fibro- as well as the granulotuberculomas do not show any tendency toward necrosis or caseation, although specific tuberculous tissues profusely permeate the primary tissue in the form of isolated or confluent tubercle structures. Fresh tumors are rich in capillaries, while older ones are essentially poorer in vessels and may degenerate edematously or even myxomatously. Tumorous structures can also appear in non-tuberculous larynges, but then, of course, without the admixture of specific tissue. The macroscopical diagnosis of a tuberculoma can be made only if other specific changes can be proven in the larynx. In other cases the diagnosis can be made with certainty only by a biopsy.

Pachydermic tumors are caused by a chronic irritation and represent a hyperplasm of the squamous epithelium. They are found not only in tuberculosis, but also in chronic laryngitis. One finds in tuberculosis in the depth of these proliferations in the connective tissue root occasionally even closely under the epithelium typical tubercles with Langhansian giant cells.

SYMPTOMATOLOGY.

In the beginning, laryngeal tuberculosis frequently causes no trouble, so that the patient consults a physician only after

the tuberculous process has already progressed to a more advanced stage. In consumptive patients, therefore, the apparently healthy larynx must also be examined at regular intervals. Sometimes it may happen, however, that changes in the larynx become conspicuous at an early date, a fact that causes the patient to go to a physician, who can then find tubercular changes in the larynx as well as in the lung. The first complaint of the patient is usually limited to a slight feeling of pressure and irritation of the throat. Frequently he feels dryness and burning. He notices a certain roughness in the voice and tries frequently during the day to free the vocal cords by a strong clearing of the throat. The voice tires readily after a longer conversation. It becomes hoarse, especially toward the evening, while a change is hardly noticeable in the morning. Real hoarseness is very seldom observed in the early stages of the disease. It is dependent not only on the spread of the disease, but especially on the location of the latter. The hoarseness may often disappear for weeks or months, only to start all over again in a greater degree. The timbre of the voice of the phthisic is however not entirely altered by the tubercular changes in the larynx. The voice may be particularly weakened either because of: *1.* An unfavorable constitution of the patient; *2.* A decrease in the vital capacity of the lung; *3.* An insufficient closure of the glottis in the voice production, or *4.* Also finally because of a weakness of the muscles of the vocal cords (M. internus). Therefore, a weakened voice must not necessarily lead to the diagnosis of a laryngeal tuberculosis. Paralysis of the recurrent nerve because of infiltration or shrinkage of the apex of the lung or glandular diseases (rarely) may likewise lead to a serious hoarseness.

During the advance of the tubercular process in the larynx the destruction of cartilaginous tissue may take place. The patient feels pains in swallowing that under certain conditions may be so violent that he refuses to take food. In tumor-like thickenings which reach far into the laryngeal lumen, in strong edematous swellings and in advanced perichondritis, breathing obstacles and even the most serious symptoms of suffocation may develop. The incipient tuberculosis of the larynx may easily be overlooked. Frequently the phthisis of the larynx is preceded by a kind of incubation period, during which the patient complains only of slight hoarseness and

early fatigue in talking. At this stage we find laryngoscopically no typical changes, but only a slight congestion of the back wall, or the vocal cords, all of which is more pronounced on one side than on the other. This symptom, which is called prelaryngitis by several authors, is sometimes the first symptom, which draws attention to inactive tuberculosis of the lungs and is, therefore, of special diagnostic importance. The reddening of the vocal cords is always a suspicious symptom of an incipient tuberculosis, although it is by no means a definite sign. The anemia of the laryngeal mucous membranes may be a symptom of laryngeal tuberculosis as well, but it must be kept in mind that anemic people also frequently show pale mucous membranes.

In infiltration we almost always see an increase in substance which strikes the eye by its redness and which may be differently shaped according to its location. Frequently we see in it yellow-gray nodules. While the vocal cords show mostly a spindle-shaped swelling, the vocal folds are more often infiltrated in their entirety. With stronger infiltration the epiglottis takes on a puffy shape; the same is true of the aryepiglottic folds. The arytenoid cartilages may also exhibit as considerable swellings at the back wall of the larynx. The back wall of the larynx is a predilected location for the pachydermia.

The edemas which appear in the laryngeal tuberculosis are found preeminently on the epiglottis, on the aryepiglottic folds, the arytenoid cartilages and the vocal folds.

In addition to the infiltrates we observe the ulcerations. The incipient ulcerations often appear as small superficial defects of the epithelium. Their diagnosis can under certain conditions be facilitated by painting the suspicious parts with a 2 per cent solution of fluorescine, whereby the ulcerations take a greenish stain, while the intact mucous membrane does not stain at all.

An especially mild form of tuberculosis of the larynx is lupus. The subjective symptoms are very small in number. The entrance of the larynx is usually struck first, that is to say the epiglottis, later the vocal folds and the back wall. One finds pale infiltrations with small bumpy granulated surfaces. Ulcers develop only rarely, far-reaching ulcerations never.

The *treatment of laryngeal tuberculosis* is divided into general and local treatment. The general treatment is the same as the general treatment of consumption. The same favorable climatic and hygienic conditions which we require for the consumptive, we must also obtain for the patient struck with laryngeal tuberculosis. In many cases the consumptive state of the patient already forces him to be brought into a sanitarium, which should be equipped with all the modern facilities for the treatment of tuberculosis of the larynx. Formerly, sanitaria for consumptives refused patients with laryngeal tuberculosis, but this is no longer the case today. The treatment of consumption must go parallel with the treatment of the phthisis of the larynx. Laryngeal tuberculosis, just as consumption, may be cured in any climate, yet we strive to obtain for every patient of laryngeal tuberculosis an air as free from dust as possible in a wind-proof location with little fog and not too frequent precipitations. For many years it was considered right to send patients with laryngeal tuberculosis south, to Egypt or to the Mediterranean Riviera, in the assumption that recovery would ensue solely through dry and warm air. The sanitaria in Egypt are absolutely unfit for patients with tuberculosis of the larynx. The constant dryness of the air, the tremendous masses of dust, which enter the houses even at the slightest wind over and over again, lead to new irritation symptoms and to the aggravation of the laryngeal process. The conditions on the Mediterranean Riviera are more favorable. The same seems to be true of the climate of Florida. For a long time the climate of high regions was considered bad for laryngeal tuberculosis. It was at first believed that cold would harm the laryngeal phthisic. We know today that this assumption was erroneous. The Alpine climate is characterized, as we know, by a low atmospheric pressure, low oxygen content of the air, dryness, very low temperatures during the winter (partly also during the summer) and great insolations. The dryness of the air often leads to a pharyngitis sicca, which, however, heals quickly as a rule. Patients with serious dysphagia and an irritating tormenting cough will, however, not be sent into high altitudes, because, as we know from experience, the dry and cold air does not agree with them. In these cases, therefore, all kinds of damp inhalations are advisable and yield good results.

In many cases it may be necessary to recommend a change of profession to the laryngeo-tuberculous patient. Constant contact with dusty air may be the cause of the constant irritation of the laryngeal membranes and favor a further spread of the tuberculosis. Patients who are forced to talk a great deal and with great effort will do better to look for a more appropriate occupation.

The nutrition of the laryngeal patient needs special attention. Strongly spiced dishes are to be avoided, and very varied food with high vitamin content should be taken. For swallowing pains the patient is given only liquid and pappy food. Alcohol, if taken in moderate quantities, has no unfavorable effect on the laryngeal tuberculosis. Drinks should not be taken either too cold or too hot. In quite a number of cases we have given the saltless *Gerson diet* over a longer period. But we were not in a position to ascertain whether the patients who were subjected to this diet recovered more readily from laryngeal tuberculosis than those who were not. Of special value in the treatment of laryngeal tuberculosis is vocal rest. This method tries to achieve the greatest possible state of tranquility of the larynx. It takes a great deal of energy, indeed, completely to renounce the use of the voice for many months. This cure of silence prohibits not only loud talking but also whispering, which under certain conditions may be even more of a strain for the larynx.

In order to bring the larynx into a tranquil state, the exclusion of coughing is of special significance. We know that the dry laryngeal catarrh is an especially predisposing factor for laryngeal tuberculosis, because the sputum sticks to the dried out mucous membranes of the larynx and facilitates the entrance of the bacilli through the cracked atropical mucous membranes. Recourse to narcotics may be had only if they will not prevent the expectoration. We must, however, consider that the cough which comes from the larynx has a certain physiological value as a defensive weapon of the organism with the purpose of removing the harmful secretions from the body and preventing the presence of the bacilliferous sputum in the larynx. In taking its course the laryngeal tuberculosis is largely dependent on the accompanying disease of the lungs and we, therefore, observe, not infrequently along with the healing of the consumption, a simul-

taneous healing of the laryngeal tuberculosis. The laryngeal tuberculosis does not offer any counterindications for an artificial pneumothorax or thorecoplasty.

LOCAL TREATMENT.

Of the numerous medicines which have been used in the local treatment of tuberculosis of the larynx, mentholated oil of 5 to 10 per cent solution, applied on the larynx, has proven especially valuable. One keeps the patient phonating, whereby the larynx is erected and the trachea protected by the closed glottis then one injects 1 to 2 cc. under control of the laryngeal mirror. Smaller ulcers may heal and infiltrates recede under the influence of the mentholated oil. Chaulmoogra oil (Ol. Gynocardiae), which may likewise have favorable effects, is injected in the same manner and quantity. The treatment with lactic acid in the form of painting with a 30 to 80 per cent solution is frequently given in ulcerous processes by many laryngologists. The use of powders, spread into the throat, is less reliable. One of the most frequently applied powders is iodoform, vioform and anesthesine. Special attention should be paid to the treatment of laryngeal tuberculosis with gold. Spiess and Feld were the first to use krysolgan. In the course of time various other products have appeared on the market (Triphal, Sanocrysin, Aurophos, Lopion, etc.). In some cases we have had good experiences with Solganal. The treatment with tuberculin is no longer popular in tuberculosis of the larynx.

The surgical treatment of laryngeal tuberculosis has undergone many changes. Th. Heryng (1887) has opened the era of surgical treatment of the phthisis of the larynx. He believed that he was able to transform the malignant ulcerations into innocuous ones by the greatest possible destruction and the removal of the tuberculous infiltrates. He also believed in combating dysphagia successfully by the stimulation of cicatrization. Gruenwald (1903) recommended the so-called galvanocaustical deep puncture (Tiefenstich). By this method we destroy the deep reaching infiltrates, safeguard the surface and stimulate strong cicatrization. Formerly, tracheotomy and thyreotomy were frequently made for the purpose of a radical removal of the diseased parts, even the total extirpation of the diseased larynx was made, but today this method has been generally abandoned. The indications and counter-

indications for surgical action in laryngeal tuberculosis make especially high demands on the skill and conscientiousness of the surgeon. Consideration must be given to the general condition of the patient. Not only the diagnosis of his condition in the pathological anatomical sense must be decisive, the progress of the lung and its prognosis must be seriously considered. Phthisis of the larynx with extensive acutely progredient lung processes have to be excluded from surgical operations. Constant rise in temperature, deep remissions, likewise form a counterindication. The curve of weight must be considered. Positive urochromogene, and diazo-reaction also preclude any operative action in the larynx.

The test of allergy, the differential picture of the blood and the rapidity with which the red blood corpuscles decrease (sedimentation test) give us valuable indicators for the practicability of an operation. The practicability of an intensive endolaryngeal treatment must be decided upon in each separate case of an existing pregnancy. In simultaneous nephritis and diabetes the chances of successful operative therapy are very small. Furthermore, the mental state of the patient plays a great part. In some cases a slight curettage or galvanocautery with the necessary preparations produce a psychic trauma in tubercular patients from which they recover with great difficulty. With a good resistance of the organism, even advanced tuberculosis of the larynx can be operated on successfully, while in a lowered state of resistance (immunity) the galvanocautery on even a small local ulcer can become dangerous.

Ambulant surgical treatment of the laryngeal tuberculosis can be undertaken only in light cases. There also a reactive edema may be the response to even a small operation in the tuberculous larynx with serious or disastrous consequences for the patient. More serious endolaryngeal operations should always be performed in a hospital. All patients with tuberculosis of the larynx should be notified as late as possible of the coming operation and the night before they must be supplied with sufficient sleeping powders. Operations on the larynx should be the first operation early in the morning. All laryngeal operations may be made with local anesthesia. For the best possible anesthesia in the larynx, which will spare the patient as much pain as possible, it is advisable first to

make a bilateral nerve blocking anesthesia of the N. laryngeus superior, and this is most easily done on its passage through the membrana hyothyreoidea. The latter is easily found with the hand between the large cornu of the hyoid bone and the upper edge of the thyroid cartilage, especially easily in phthisics who generally have a throat with little fat, in which the anatomical details are easily palpable. Once the loss of nerve conduction of the N. laryngeus is achieved, the patient will be only very slightly annoyed by the painting of the larynx with a surface anesthetic (at present we use a 2 per cent solution of pantocain). This obviates the tormenting cough irritation which occurs in the case of painting the interior of the larynx with even a 20 per cent cocain solution without previous anesthesia of the N. laryngeus superior. Many laryngologists prefer the endolaryngeal operations in indirect laryngoscopy, which must, of course, be at the command of every laryngologist. We personally prefer the suspending laryngoscopy with Seiffert's modification, because this method can be applied without causing extra pain when well anesthetized and the surgeon has both hands free for the operation. Circumscribed seats of tuberculosis, tumor-like and papillary excrescences as well as granulations on the ulcers are best removed by means of the curette, which is immediately followed by the galvanocautery. Besides the destruction of the tuberculous tissue, the galvanocautery procedure has the purpose of stimulating strong cicatrization. In few cases it is possible to destroy the tuberculous tissue in a single session. Most frequently we are, however, forced to repeat the galvanocautery application in several sessions at intervals of two to three weeks. The surgical treatment of tuberculosis of the epiglottis consists mainly, and especially in advanced cases, in the amputation of the epiglottis, which can be made with either Schmidt's or Jurasz' forceps, with Alexander's guillotine or the hot or cold snare. There is no danger of an aspiration after the removal of the epiglottis. In the act of swallowing the larynx is raised. Thereby it presses against the base of the tongue, which is pushed backward so that a perfect closure of the entrance of the larynx is established. In this way the swallowing passage leads into the food passage on both sides of the larynx through the sinus piriformes. In the electrocoagulation of the tubercular larynx, greatest precaution is to be observed, as we have often emphasized. For although electrocoagulation is fit to

destroy tuberculous tissue in an ideal way, it may, on the other hand, produce repeatedly postoperative edema with very serious consequences. The good cicatrization which follows electrocoagulation is not desirable in the larynx, because electrocoagulated scars are very tight and coarse, and may, therefore, easily lead to stronger strictures and disturbances in motion.

The smallest possible use is made today of extralaryngeal operation in the tuberculosis of the larynx. Curative tracheotomy can only be considered in very serious laryngeal tuberculosis, when the lung is only very slightly affected and in cases of the most serious dyspnea. On the other hand, tracheotomy is always dangerous, especially for the tuberculous lung, because of the frequent outbreak of a secondary catarrh. For those surrounding the patient, the tracheotomy is of great peril, because through the tracheostoma, tubercle bacilli are very easily scattered about in the sick room. The extirpation of the tuberculous larynx is an extremely serious operation and only very few phthisics recover afterwards. Those cases of tuberculoma which cannot be treated endolaryngeally may require a thyreotomy. But the opening of the larynx is a serious operation for the phthisic and is justified only if in one session all the diseased tissues can be removed. Since the tranquillization of the diseased larynx has always been "a consummation devoutly to be wished," Leichsenring has conceived the idea of blocking the recurrent nerve by means of alcohol injections. With a fine needle, about 6 cm. long, one punctures sidewise immediately next to the first tracheal ring, palpating down as far as the spine. Then one retracts the needle about 1 cm. and injects 1 cc. of 80 per cent alcohol, to which we recommend adding some procaine, moving back and forth during the procedure. After several minutes paralysis of the recurrent nerve takes place and lasts about four weeks. One may also squeeze or cut through the recurrent nerve near its entrance into the larynx, between the treachea and the thyroid cartilage, whereby a paralysis of longer duration is achieved.

V. d. Hütten has described a process of icification of the recurrent nerve. This method has not become popular, because, in proportion to the expected results, it means too great an operation for the phthisic of the larynx.

RAY THERAPY OF TUBERCULOSIS OF THE LARYNX.

The beginning of a light therapy of tuberculosis of the larynx dates back as far as 30 years. At first sun rays were conducted into the throat and laryngeal regions.

In order to be independent of the sun, recourse was taken to the ultraviolet rays of the quartz lamp. The sun ray treatment was conducted, according to the descriptions of Sorgo, in such a manner that the patient sits with his back to the sun on a chair, which has a movable plane mirror attached, which reflects the sun rays.

The patient lets the rays fall into his mouth, and with a second mirror he observes whether the uvular region, to which he holds a laryngoscope, is lighted by the sun rays. In order to relieve the patient from the uncomfortable sitting posture, he was soon placed on a reclining chair in such a position that he had the sun in front of him with easy access to his open mouth. The rays fall directly on the pharyngeal wall. By means of a small mirror, which he held with the left hand, the patient could control the correct adjustment of the laryngoscope. Sunglasses were given to the patient in order to spare him the annoying strain on the eyes caused by facing the sun.

Heliotherapy is not very popular. The quartz light treatment has found more followers. It is very similar to the sun therapy. The rays of the quartz lamp are first made to fall on a plane mirror, from there they are caught by a laryngoscope on the uvular region and lastly they are reflected on the larynx under control of a small mirror.

In order to avoid the absorption of ultraviolet rays through the glass mirror, Cemach has devised a quartz lamp for direct laryngoscopy. The patient is brought into suspending laryngoscopy. Then a Kromayer water-cooled lamp is brought to the edge of the lips, so that its rays strike the seat of the disease through the laryngeal pipe in immediate vicinity. The light is applied two to three times per week for no longer than ten minutes at a time. The Viennese school reports favorable results from this method.

The universal carbon arc light, used by the Danish scientist, Finsen, was introduced into the therapy of laryngeal

tuberculosis about 15 years ago by Reyn. How the light acts on the tuberculosis of the larynx is still an unsolved question. It is to the credit of Ove Strandberg that he has had very good results with the carbon arc light in laryngeal tuberculosis. It is possible that an unspecific stimulating effect is involved, but it may also be assumed that the light rays work in the sense of an autotuberculinization.

In order to carry out the Finsen ray treatment, electric carbon arc lamps are being used, in which the proportion between coal dimensions, voltage and amperage are so calculated that the lamps send out the greatest possible amount of ultraviolet rays.

In the Finsen Institute, in Copenhagen, two standard types are used for this purpose, namely, lamps for 75 and for 20 amperes, respectively. Both types of lamps work with direct current, with an arc voltage of about 55 volt and line voltage of about 70 volt.

In the use of direct current the light arc forms a crater in the positive carbon, from which the greater part of effective rays is issued. The lamps are suspended from the ceiling in such manner that the positive carbon is vertically attached over the negative and the light arc is about 1.25 m. over the floor.

From about six to eight people can sit around two such lamps at the same time and benefit through simultaneous ray treatment. According to Strandberg's experience, even patients with morning temperatures of 100.5° to 101° F. can stand the light baths very well.

As counterindications in the Finsen institute, we find only albuminuria and decompensated cardiac defects. We have convinced ourselves of the success of the carbon arc light treatment of laryngeal tuberculosis in the Finsen Institute in Copenhagen. It must be said, however, that the carbon arc treatment alone is insufficient in many cases. In some cases it must be supplemented by a special local treatment of the larynx.

Hajek and Wessely hold the opinion that the simple carbon arc light bears too little similarity to the sun light, and that the local ray treatment is preferable to general ray

treatment. Therefore, for their patients with laryngeal tuberculosis they use a modified carbon arc lamp whose electrodes are not pure carbons, but show the addition of metal salts.

The Wessely lamp has quartz optics, which more than through glass permit the short waved rays to penetrate easily. As in the Reyn-Finsen lamp, the rise in temperature of the environment is checked through a water jacket. The light is thrown upon the diseased larynx either directly or indirectly with the help of a metal mirror.

Forty-four per cent of the rays in the critical spectral optical region are hereby reflected. The individual session lasts about five to ten minutes in the beginning every other day, later on at longer intervals. The entire ray treatment lasts up to one and a half years.

THE X-RAY TREATMENT OF LARYNGEAL TUBERCULOSIS.

Brünings was the first one to try X-ray treatment of the diseased larynx by means of the autoscopical, that is to say, the direct way with the help of the Mueller-Uri tube. After several modifications of Brünings' method the peroral route was, however, abandoned for the X-ray treatment of laryngeal tuberculosis and today only the percutane method is used.

How do the X-rays affect the larynx? It has been proven that they do not exercise an immediate influence on the tubercle bacilli. The question arises, therefore, which of the cells are actually touched by the X-rays, and to which extent do they respond to this action?

The lympho- and leukocytic elements are especially radiosensitive and readily perish after minimal X-ray doses. Therefore, it seems obvious that the development of the connective tissue after X-ray treatment is based on the breakdown of the lymphocytes, which is supposed to stimulate cicatrization. Not only the lymphocytes, but the cellular elements of the reticuloendothelial apparatus as well, such as the histiocytes, fibroblasts and epitheloid cells are very sensitive to X-rays.

In the curative process of tuberculosis we observe biopositive and bionegative processes, which may be followed by a productive fibroblast reaction or by an exudative necrosis

(Gassul). The X-rays represent a highly effective factor with which it is possible to obtain stronger reactions of the seat of the disease than with other unspecific stimulants. They are, however, a two-edged sword, the correct use of which is not very simple.

The X-rays are supposed to create general immune biological processes in the body. Besides they have to support, accelerate and confirm by means of a well dosed amount of energy, absorbed on the seat of the disease, the natural attempts of defense of the organism. And this is possible only if there exists a sufficiently powerful granulation tissue, which has the ability of transforming into cicatrization tissue.

X-rays are, therefore, in the first place indicated in all chronic, progressive, stationary, latent, productive forms of laryngeal tuberculosis. All acute progressive and progressive exudative and mixed forms, however, as well as all forms accompanied by stenosis and serious disturbances of the general condition must be excluded from X-ray treatment.

If the organism succumbs to the mass of infectious germs and their poison production in its defense, then X-rays are not only powerless, but even harmful. The *"primum non nocere"* is the highest law also in the X-ray treatment of the laryngeal tuberculosis. One should not treat with X-rays only *"solaminis causa,"* if one is not sure not to harm the patient. An existing dysphagia is also rarely improved by X-ray treatment. The simultaneous application of gold preparations with X-ray treatment has been suggested by Spiess and Rickmann.

In order to combine the penetrating power of the hard rays with the biological effect of the soft rays, Brünings recommended the insertion of a short metal tube, as closely fitting as possible into the larynx, in order to throw the rays on the diseased part with hardest possible rays from a direction, corresponding to the tubercular area. The metal surface, which is thereby hit, sends out soft secondary rays with a very strong surface efficacy, from which a particularly good influence was noticed on the ulceration.

The strength of the X-ray dose in the treatment of laryngeal tuberculosis still fluctuates with the opinion of different authors. But it may be assumed that the ray optimum in

laryngeal tuberculosis lies between 5 and 10 per cent of skin erytheme dose.

Because of the sensitivity of the cartilage and the perichondrium, one must always strive to get along with the smallest possible dose, with strict avoidance of any strong reaction. The maximum dose of 10 per cent for the seat of the disease should never be exceeded in one session.

In laryngeal processes whose inflammatory character is not entirely ascertained, it is possible under certain conditions to treat with a dose of less than 5 per cent. Some authors recommend ½ to 1 per cent skin erytheme dose throughout.

Through continuous examination of the patients, one is able to observe superficial small reactions in the seat of the disease in the larynx, whose disappearance must be awaited until the next treatment.

The treatment is best made by means of the Coolidge tube with 24 cm. focus-skin distance, 20 to 25 mill. amp. power of current, 160 K.W. tube tension under 4 mm. Al. or 0.5 mm. CU. + 1 mm. Al.

Best results with the homogeneous treatment of the entire larynx in all its parts are obtained by means of the crossfire.

The structure of the throat makes it comfortably possible to reflect the rays upon the entire larynx from two or three fields and from both sides, and to direct the central rays so that they meet the tubercular larynx with some certainty. Since the seat of the disease is at a distance of 3 to 5 cm. from the surface, the loss of rays through the absorption and dispersion is relatively small.

Since the larynx of women is more sensitive to rays during menstruation, it is advisable to interrupt treatment during this period.

Radium treatment has also lately been used in tuberculosis of the larynx. Haardt has observed good results with radium treatment. He introduces radium by means of a small tube into the anesthetized larynx. The little tube is held by means of a clamp, to which a silk thread is attached (for safety's sake) and the clamp fastened to the mucous membrane by means of a mouse tooth forceps.

The individual dose of the radium ray treatment amounts to 25 to 50 mg. hours. The interval between the separate sessions lasts at least four weeks. In most cases three treatments are sufficient; more than six treatments have never been used.

Not much is known as yet about the effectiveness of radium in the tubercularly diseased larynx. The best reactions are shown by circumscribed infiltrates, especially on the back wall of the larynx while it is more difficult to obtain good reactions in ulcerations.

An important chapter in the treatment of the laryngeal tuberculosis is the combating of dysphagia. Since it is not possible to keep the larynx constantly under cocaine, it must suffice to introduce anesthetics in special forms into the larynx or its environment. The best effects were hereby obtained by the use of dysphagine, a combination of tutocain, anesthesine and menthol. If this treatment does not lead to the goal, an anesthesia of the laryngeal superior nerve is necessary; it is made with an alcohol injection. One cc. of 80 per cent solution of alcohol is injected with additional procain (1 per cent) into the laryngeal superior nerve before its passage into the hyothyreoidean membrane, as was described above. It is best not to inject both nerves in one day, in order to avoid a stronger aspiration of saliva and food. This anesthesia generally lasts for four weeks and may be repeated *ad libitum*. Squeezing or cutting through of the nerve represents a more radical procedure. The nerve is easily found in the hyothyreoidean membrane.

One more word on the question of laryngeal tuberculosis and pregnancy. It is a well known fact that tuberculosis of the larynx is more strongly influenced by a pregnancy than all the other tubercular affections in the body. The interruption of pregnancy is of value to the laryngeal tuberculosis only, if it is done early enough; that is, within the first three months. Even light, seemingly quite early cases of laryngeal tuberculosis may be unfavorably influenced by pregnancy and may be brought to a rapidly progredient development. Interruptions after the third month are not as successful as those in the first months of pregnancy. The induction of a premature birth in laryngeal tuberculosis is generally without success and even often harmful and should be avoided.

The prognosis of laryngeal tuberculosis is to this day a doubtful one. Felix Semon, one of the founders of modern laryngology, to whom England has become a second home, said once that one could not speak of a cure in laryngeal tuberculosis. We believe that our treatise has shown that today we do not have to accept so pessimistic a point of view. Especially is this the case if we are conscious that the laryngeal disease is not a disease by itself, but is closely allied to the whole body and is only a part of the entire tuberculosis condition of the patient. Thus it may be treated with a modicum of success in strictest co-operation with laryngologists, general practitioners, diagnosticians and X-ray men.

667 Madison Avenue.

AMERICAN OTOLOGICAL SOCIETY, INC.

The Sixty-eighth Annual Meeting of the American Otological Society will be held at the Royal York Hotel, Toronto, Canada, Monday, Tuesday and Wednesday, May 27-28-29, 1935.

The meeting will be followed by the meetings of the American Laryngological Association, May 29-31; the American Bronchoscopic Society, June 1, and the American Laryngological, Rhinological and Otogolical Society, June 3-5. All the meetings will be held at the Royal York Hotel.

A program of high scientific interest has been arranged which will include two important symposia, one having to do with the question, Is There Localization in the Cochlea for Low Tones? and the other on a Consideration of Certain Fundamentals in Regard to Suppuration of the Petrosal Pyramid.

Toronto is easily reached from all directions by rail and by automobile, and is a delightful place to visit in the summer.

For further particulars address Dr. Thomas J. Harris, Secretary, 104 East 40th street, New York.

THE HISTORY OF THE SURGICAL TREATMENT OF OTOGENIC ABSCESS OF THE BRAIN.*

DR. LEO M. DAVIDOFF, New York.

Scientific treatment of any disease must await the time when this disease itself is recognized as an entity. After this the treatment may suggest itself at once, or it may be delayed decades or even centuries until some specific discovery, like that of insulin; or a new principle, like that of antisepsis, occurs. In the case of otogenic brain abscess the nature of the disease was suspected down the ages from Hippocrates to Morgagni. Indeed, it was the latter who, early in the eighteenth century first refuted the impression that ear suppuration results from brain suppuration, but "on the contrary, abscess of the brain results from suppression of discharge of the ear"; however, the first full and critical description of the relation of middle ear infection to abscess formation in the brain was made by Lebert in 1856, based upon a study of 80 cases.

The surgical treatment of brain abscess, especially when following trauma to the head or scalp, was attempted now and then much earlier than Lebert's proof of ear infection as the etiological factor in the major proportion of cases. Thus, it is reported that Mathew Ludwig Glandorp in the middle of the seventeenth century attempted incision of the dura in the case of a subdural abscess, as did Antony Boirel according to a report in 1677. Jean Louis Petit, in a book published in 1790, described a post-traumatic case in which he trephined and incised the dura, after which the brain abcess ruptured itself.

The great French master of surgery of 100 years ago, Dupuytren, in his famous lectures declared that, "in certain cases of deeply seated fluid collections we must incise the dura mater, the arachnoid, the brain itself, if the focus is

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at the surface of this organ, and by this bold proceeding patients have been saved. It has fallen to my lot to do so several times with success." The description of his operative procedure is the very essence of simplicity: "I incised the dura mater, nothing came out; I thrust the bistoury cautiously into the brain and there welled up immediately a flood of pus. That very night all the symptoms disappeared and the patient recovered." While Dupuytren's immediate result was brilliant the patient eventually died; and his more conservative colleagues gravely shook their heads in silent disapproval. Great and courageous surgeons like Sir Astley Cooper, trembling to plunge their bistouries into the seat of corruption, stayed their hands in deference to the prevailing opinion of the untouchableness of the organ of the soul.

In 1885, Schondorff reported a cured case of temporosphenoidal otogenic brain abscess, but in this case a fistula leading from the abscess into the mastoid was present as a result of spontaneous rupture, which eventually healed. Truckenbrodt, the next year, also reported a cured case following operation, but the operation consisted simply of removing some necrotic bone from the temporal region, whereupon the abscess was immediately disclosed. The first accurately diagnosed and critically planned and executed operation with cure of the patient belongs to the credit of Gowers and Barker, also in 1886. Their patient was a boy, age 19 years, with a history of chronic right middle ear infection of many years' duration, who developed drowsiness and headache and who on examination also showed papilloedema. The right mastoid was explored and chronic inflammation was disclosed. He improved considerably after this operation for a few days but then again became stuporous. At this time Gowers made the diagnosis of right temporosphenoidal brain abscess. Barker, after orientating himself with craniocerebral measurements, trephined the patient, under chloroform anesthesia, $1\frac{1}{4}$ in. above and $1\frac{1}{4}$ in. behind the external auditory meatus. The dura was then incised and exploration was made with a hollow needle, which resulted in a flow of purulent material. The brain overlying the abscess was then removed by means of a curette and the whole cavity laid bare. After this it was carefully washed out with an antiseptic solution and drainage provided for by means of a rubber catheter. A few days after operation the drain was replaced by a silver tube, which

was permitted to remain in place for several weeks. The patient made a complete and uneventful recovery.

Following this report the operation was frequently performed, especially in Great Britain, and successful case reports appeared in the literature by Greenfield, Macewen, Horsley and others in quick succession. This form of treatment offered a ray of hope in a condition which is otherwise almost certainly fatal and it became established as the only recognizable treatment in a very short time. As is true of any new procedure, the tendency at first was to report only the successful cases and to publish single case reports. In a very few years, however, statistical studies on larger series of cases treated by some one surgeon or by several surgeons in one institution began to be published. Thus, from St. Thomas' Hospital 19 operated cases of cerebral abscess with 17 deaths, seven cerebellar cases with six deaths, and two cases of cerebral and cerebellar abscess with two deaths were reported to have occurred from 1899 to 1904. Similar statistics were made available from St. Bartholomew's Hospital and the Leed's Infirmary, and the appalling mortality began to curb the surgical enthusiasm. In fact as early as 1889 von Bergmann made an earnest plea for the surgical treatment of brain abscess, not only to make new converts to this type of therapy but to encourage those who had tried and failed. Perhaps the greatest stimulus to continue the effort came as a result of the genius, courage and skill of William Macewen, who in 1893 published his book on "The Pyogenic Diseases of the Brain and Spinal Cord," in which he reported 19 operated cases of brain abscess, 18 of which recovered. This record remains unequaled to this very day, but slowly the combined experience of many surgeons and the knowledge gained from other types of brain surgery is leading us on to the standard set by Macewen. Today the general average of mortality in surgically treated cases of abscess of the brain is somewhat more or less than 50 per cent, with a distinct tendency toward improvement, indicated by such figures as Coleman's, for example, who reported on 28 cases in 1930 with 19 recoveries.

No sooner had the operation been instituted than discussions occurred at every surgical meeting, great or small, as to the best technique to be followed. For the first 35 years

all surgeons and, even until now, the majority of surgeons patterned their operative procedure upon the earliest reports by Barker, Greenfield, Macewen, Horsley, etc., differing only in details. But these details were each fought over, sometimes quite bitterly, and even today continue to be objects of contention. Given a patient with the diagnosis of otogenic brain abscess of the temporosphenoidal lobe, or the cerebellum, established, the problems to be met are as follows:

1. When to operate. *2.* Where to operate. *3.* What anesthetic to use. *4.* How large an opening to make. *5.* How widely to open the dura. *6.* What instrument to use for probing the brain. *7.* Whether or not to wash out the cavity. *8.* Whether or not to drain. *9.* What type of drain to use. *10.* How often to dress the wound. *11.* How often to change the drain, if at all. *12.* How long to continue the drainage.

Let us examine each of these individually and see how it has been met in the past and how our present usage concerning it came about.

Of all these problems the one upon which opinions down the decades have been most unanimous is when to operate. The consensus has been up until now to operate as soon as the diagnosis is made. The difficulty in diagnosis until definitely localizing neurological signs appear has usually resulted in delaying the operation until the abscess had become more or less well encapsulated. It is quite true that occasionally more acute abscesses were met at the operation, which gave rise to new problems specific unto themselves. But it is not until the last 10 or 15 years, when experience has taught us to evaluate less definite neurological signs in the diagnosis of this condition, thus making such a diagnosis possible much earlier, that doubt has been cast upon the wisdom of operating without delay. This has culminated in the advocacy by Grant of definite postponement of the time of operation in early cases, based upon his study of 49 operated cases. Of these, 19 were unencapsulated abscesses, all of which succumbed; whereas, of the 30 with encapsulated abscesses 20 were cured.

The question as to what route to follow in the approach to an abscess has led to a controversy which is apparently still unsettled. The contenders are divided essentially into

two groups, to-wit: those who believe that the abscess should be searched through the mastoid wound, and those who believe that it should be approached by a fresh opening through the squamous portion of the temporal bone. The arguments advanced for either side are numerous and often descend beneath the dignity of scientists. Essentially, however, those in favor of the temporal approach believe that this avoids the danger of carrying infection into the brain, if not already there; and the chief point of the opposite-minded is that the logical approach to an accumulation of pus is along the pathway of infection, which in these cases is from the middle ear by way of the mastoid to the brain. As a matter of fact, the argument has continued by the strength of its own inertia, for Sir Victor Horsley quietly settled it as long ago as 1912, when he declared that the approach to the abscess is through the mastoid when the tegmen is found to be eroded, and through the squamous bone if the pathway of infection to the brain is not seen during the mastoid exploration. What actually happens is that the otologist who operates upon a mastoid follows wherever the suppurative process leads him, even if into the brain. If the mastoid operation did not necessitate exposure of the dura, but later on brain symptoms develop, the mastoid wound is reinvestigated and all additional visible suppuration removed. If the direct pathway from the mastoid to the brain is still not found and the diagnosis of a brain abscess is clear, exploration for the abscess through the squamous bone is now made. It is at this stage that the neurological surgeon, as a rule, first sees the patient, and this, in the writer's estimation, accounts for the preference by the latter of the approach through the squamous portion of the temporal bone (or the occipital bone in a cerebellar abscess), and the preference by the otological surgeon for the approach through the mastoid.

The choice of anesthetic has varied with the custom of any given period. The earliest modern operations abroad were done under chloroform; in this country, under ether. At the present time, the tendency among neurological surgeons is to utilize local infiltration anesthesia with procaine.

Concerning the size of the opening in the skull, the majority of surgeons have followed the precedent set by Barker of making an opening of about $1\frac{1}{2}$ in. x $1\frac{1}{2}$ in. (2.75 cm. x

2.75 cm.). Others have advocated as small an opening as possible for fear of brain herniation. Still others, notably Eagleton, prefer to make an osteoplastic flap. In the same way, opinions vary concerning the size of the opening in the dura and for the same reasons. The present practice in the majority of instances by Adson, Coleman, Dowman, Elsberg, Grant and others is to make a trephine hole and enlarge it to the size approximately similar to that made in Barker's original case. This makes the operation a simple one, yet allows adequate room for exploration, and by suturing the wound up to the drain, cerebral herniation is prevented.

Most modern surgeons try to close off the subdural and subarachnoid space during the operation by packing plain or antiseptic gauze under or over the dura, although in the earlier days this point was neglected.

At the first modern operation for otogenic abscess, the brain was explored with a hollow needle, the latter undoubtedly being sharp pointed. Because of the large percentage of patients who died in spite of the operation every step in the technique was placed under suspicion at one time or another, and the exploring instrument was often blamed, and for this reason frequently modified. The hollow needle, the cannula and trocar, the simple bistoury, the grooved director, the blades of a straight forceps, were usually favored in the earlier decades. Then for a brief period, after the danger of leaving undrained chambers of multilocular abscesses was realized, the exploring finger of the surgeon was the favored instrument. This was soon recognized as poor cerebral surgery but its death knell was not sounded until 1912 at a meeting of the Royal Society of Medicine in London, by Sir Victor Horsley. The digital exploration was already markedly on the defensive and one of its exponents, a Mr. Waggert, to prove its worth, cited two cases. One was a patient with an abscess of the cerebellum in whom no pus was located on two attempts, then on the nineteenth day the surgeon became desperate and passed his "finger in and all over one lobe of the cerebellum." An abscess the size of a walnut was found near the internal auditory meatus. The patient recovered, lived for 11 years and became an inventor. In another badly neglected case in a moribund state, given up by another surgeon, the same speaker declared, "I passed my finger into her brain quite 20 times," and although he did not find an

abscess, the patient said the next morning that she had not felt so well in months. In his discussion, Horsley declared quite bluntly that while he congratulated Mr. Waggert on his results, in the same breath he condemned his method. This statement seems to have echoed around the world for there is very little reference thereafter to the finger as an exploring instrument of the brain.

In our own country, as a matter of fact, digital exploration was discarded much sooner by the majority of surgeons, for already, in 1903, Whiting, of this city, described his encephaloscope, which is essentially an enlarged nasal speculum with a blunt obturator to serve as a substitute for the human finger. This instrument has been modified a number of times. Eagleton added a searcher which is capable of protruding two side arms in order to retain the capsule. The most recent modification by Grant largely dispenses with the function of the instrument as a means of examining the interior of the abscess, but serves to introduce a rubber tube into the cavity without the danger of missing the hole in the capsule. The most frequently used exploring instrument at the present time is the blunt pointed brain cannula. The blunt point not only prevents the damaging of deep blood vessels, but transmits the resistance of an abscess capsule to the surgeon better than a sharp point would.

Another controversial point was whether or not the cavity is to be washed out after the pus is evacuated. The earlier cases were so treated, but later on the argument was advanced that such a procedure might cause a rupture of what is often a thin and poorly nourished wall of brain tissue between the abscess and a neighboring cerebral ventricle. Such an accident must be extremely rare, since Macewen washed out the abscess cavity regularly and so did Horsley. Moreover, it is being done today by many if not most surgeons. The one precaution which both the past masters and the present operators emphasize is that a provision must be made for the free exit of the fluid used for washing in order to avoid introducing it under pressure. This is accomplished by having a smaller inlet tube and larger exit tube either side by side, or concentrically placed as Horsley suggested. As a substitute for washing out the cavity, wiping it out with gauze enjoyed a brief and limited popularity, but was soon discarded.

With very few exceptions, surgeons past and present who operate upon brain abscess advocate the use of some form of drainage following the initial evacuation of pus from the subacute or chronic abscess. But the best type of drain to use has always been a difficult problem. At first the eye end of a rubber catheter was inserted into the cavity to serve as a drain. Later silver, glass and hard rubber tubes were used either singly or doubly, side by side or concentrically. Macewen preferred as a drain a decalcified chicken bone which is absorbable and may thus be left in place without causing worry as to the time of its removal. Objections were found to all these materials. The soft rubber tubes often collapsed, thus ceasing to serve their function as drains. The rigid tubes were thought to pierce the protective wall of the abscess cavity, thus producing an extension of the suppurative process. All types of tubes, moreover, tended to slip out and their reinsertion at later dressings was often attended with difficulties and dangers.

For these reasons gauze drains became popular in the first fifteen years of this century, but their limitation was quickly realized, for it became evident that as soon as gauze becomes soaked with pus it no longer acts as a drain, but as a plug. Wrapping the gauze in rubber tissue (cigarette drain) was then tried without much happier results. In 1915, Barany made the discovery that a single layer or several folded layers of gutta percha was an improvement over the gauze drain. The next year, Mosher, having observed the British Army surgeons make use of a perforated zinc tube drain, invented the wire gauze drain. He described it in a short paper after having tried it in three cases. In order to keep it cleaned out a swab soaked in glycerine must be poked through its lumen frequently. There is no trouble keeping it in place, he wrote, since it sticks to the granulations; indeed, it "holds in place almost too well." In 1919, Kahn described a screw-type of metal tube which was apparently intended to remain in place by the thread of the screw. Most of these, however, have now been discarded since improvement in rubber tubing prevents its collapse and the method described by Elsberg of splitting the protruding end of the tube and suturing the split ends to the scalp keeps the tube in place.

In the case of acute, unencapsulated abscesses, Macewen often simply evacuated the pus and left no drain whatsoever.

Later surgeons did not quite dare to follow in his courageous footsteps, but have advocated a much shorter period of drainage in these cases than in the chronic type of lesion. In the latter, most opinions are quite in harmony as to the duration of the period of drainage; namely, three to five or even six weeks. The modern surgeon who is not a slave to rules and numbers is guided by the quantity of pus present and begins to shorten the drain as soon as the discharge becomes insignificant, in readiness for its complete removal, when he is convinced that the flow has stopped.

At first it appeared essential to remove the drain daily and replace it by a fresh one, but this often resulted in unnecessary manipulation and spread of infection. Macewen was the first to advise leaving the drain undisturbed, but for a long time this advice was disregarded. Whiting practiced the daily exploration of the abscess cavity with the encephaloscope, and the champions of digital exploration resorted to this method at frequent intervals after the operation. Only in the past 15 or 20 years was the wisdom of Macewen again realized and followed. In fact, it was this desire to keep the drain in place that stimulated the invention of the Mosher and similar drains.

Among the distinct departures from the classical operation beyond a mere difference in details of technique must be mentioned the method of King, which consists of unroofing of the abscess and allowing the intracranial pressure to evert the cavity, thus transforming it into a brain hernia and eliminating the need for the use of a drain. Macewen had used a procedure not unlike that of King in one or two cases, but seemed to be disinclined to recommend it.

Another modern contribution to the treatment of brain abscess is the suggestion by Dandy to make a very small opening in the skull and then simply evacuate the abscess by a single puncture and close the wound. This, too, was in essence practiced by Macewen when he evacuated unencapsulated abscesses and after carefully washing out the cavity closed the wound without drainage. Finally Lemaitre has proposed a method which consists of the following: a small opening is made in the dura only big enough to permit the passage of an exploring needle. After pus is struck, the needle is replaced by a grooved director along which a filiform drain is

passed. This is left in place for 24 to 48 hours, after which adhesions have usually formed between the brain and dura. The fine drain is now replaced by a somewhat larger one and each day the size of the drain is increased until a tube of 6 to 7 mm. is reached. By this time the danger of spreading the suppuration is largely over.

The virtues of all these methods cannot be affirmed until the originators and followers of each of them will have published a substantial series of cases, stating their results, both good and bad, and permitting comparisons to be made. Meanwhile the statistics of Macewen are still to be matched. His method in substance was simply one of incision and drainage. But it was applied with almost faultless judgment, profound understanding and meticulous care. It would appear from this review that whatever the method of treatment may be, these ingredients are far more important to its success than the mechanical details over which generations of surgeons have disputed so earnestly.

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Neurological Institute.

CHLORIN GAS BURNS OF INSIDE OF RIGHT CHEEK, ANTERIOR AND POSTERIOR PILLARS, RIGHT SIDE OF SOFT PALATE, POSTERIOR PHARYNGEAL WALL, LARYNX, TRACHEA AND BRONCHI.*

DR. PHILIP S. STOUT, Philadelphia.

Possible Dangers of Chlorin Gas as a Water Purifier: While chlorin gas burns were common during the late war, reports of chlorin gas accidents in peace time are not common; however, at present chlorin gas is used a great deal for disinfecting drinking water and its dangerous character is not realized until some accidents occur. In passing, it might be noted that during the winter of 1933-34, a workman in the Water Department of the Philadelphia area died from the effects of chlorin gas as he was disinfecting the drinking water for the city. Also, several years ago, a physician developed acute nephritis and, by a process of elimination by several physicians then attending him, it was definitely shown to be due to chlorinated drinking water such as comes from the average spigot. Another, who had a dentigerous cyst removed, died of pneumonia about one week after the operation. He had received daily irrigations of Dakin Solution.

It might not be out of place to mention that perhaps some strange illnesses, such as trench mouth, mononucleosis and agranulocytic angina, may at times be precipitated by the continuous use of chlorinated water. I make this merely as a suggestion.

Report of Case: Leo S., male, white, American, age 28 years, student Philadelphia College of Pharmacy and Science.

Brief History of Accident: While he was working in the laboratory, another student, who was making chlorin gas, filled a bottle with the gas and jokingly poked the bottle under the nose of the patient. Of course, it stifled him and he drew back and opened his mouth to get some air, when, somehow, the neck of the bottle got into his mouth and in drawing his breath, he got the contents of the bottle of chlorin gas. This strangled him and for a moment he was almost

*Presented before Section on Otolaryngology, College of Physicians, Philadelphia, March 21, 1934.

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unconscious. He felt sick, giddy and weak, and soon developed a headache. He had considerable coughing and spitting. Some nine hours later his throat began to pain him a great deal, so much so that he had trouble speaking, swallowing, eating and sleeping. This pain increased until he could neither eat nor sleep; in fact, for a while he could not swallow his own sputum. He had some fever, a slight unproductive cough, hoarse voice and some difficulty in opening his mouth. There was a feeling of fullness in the head and ears. The ears felt as if they were blocked. However, examination of the ears was negative.

Patient was referred to me five days after the accident. Examination showed some irritation of the inside of the right cheek, the right anterior and posterior pillars were ulcerated (tonsils had been removed), soft palate and posterior pharyngeal wall was also affected in patches. These areas looked as if they were scalded or cooked, with redness around the affected areas; very painful to touch or swallow. His swallowing was not unlike that of a peritonsillar abscess condition.

The Larynx: The epiglottis was mottled in appearance. The laryngeal mucous membrane was congested, the cords pinkish, trachea was not seen at this examination.

He was pale, weak and nervous, having lost some weight and strength. Occasional rale was heard over the chest. Cough was short and unproductive.

Treatment: Mild alkaline antiseptics to mouth and throat. Hynoptics to induce sleep, since this condition was especially painful at night. Diet: Soft or liquid, making every effort to keep up the strength. Additional medication: Iron tonic and medicine to relieve the cough.

He is improving, although he is still weak and easily becomes out of breath.

Ten days after the accident he was examined by Dr. Louis Clerf, who found improvement in the larynx and trachea. The bronchi were not explored.

Summary: Chlorin gas is widely used for water disinfection. It is a powerful poison. I believe that the constant use of it, by old and young, is not without danger.

Presentation of Patient: Unproductive cough continued for several months after accident.

269 South 19th Street.

SEPTUM FORCEPS.

DR. M. M. CULLOM, Nashville.

I present for consideration an upward biting septum punch for use in submucous resection of the septum. While it answers every purpose of a septum bone-biting forceps, my reason for devising it was for use in the roof of the nose. Where the septum, either bony or cartilaginous, is thickened and deflected in the roof of the nose, I have experienced difficulty in engaging it with a straight biting forceps. The for-

ceps would slip off and fail to bite on account of insufficient purchase. At times I have been dissatisfied with my final result, being afraid to use too much force in that region of the nose on account of the proximity of the cribriform plate. Every nose and throat surgeon knows how important it is to remove the deflected bone to the middle line in order to have the flap hang straight; otherwise the obstruction will not be relieved. The difficulty is completely solved by this instrument; it bites the bone out cleanly, without fracturing it, and one is able to limit the amount removed exactly.

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It is also a useful instrument in the intranasal antrum operation in taking down the nasoantral wall. It can likewise be used in exenteration of the ethmoid labyrinth.

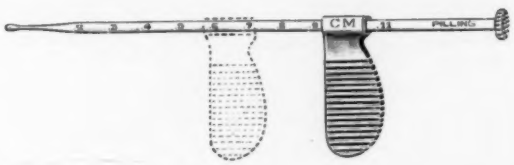
This instrument is manufactured by the C. R. Storz Co., St. Louis, whose advertisement appears on page 4 of this issue.

1119 Bennie Dillon Building.

A GRADUATED NASAL PROBE; A SPHENOPALATINE NEEDLE.*

DR. ROMEO A. LUONGO, Philadelphia.

A GRADUATED NASAL PROBE: This probe has been devised for the measurement of the depths of the structures which are encountered during the external frontoethmosphenoidal operation. The thumb piece slides along a graduated bar, which is introduced through the external opening. The tip is placed at the level of the structure to be measured and, while the bar is firmly held against the lateral nasal wall, the thumb piece is pushed down until it reaches the nasal dorsum. The reading is then taken at the lower margin of the sliding thumb piece.

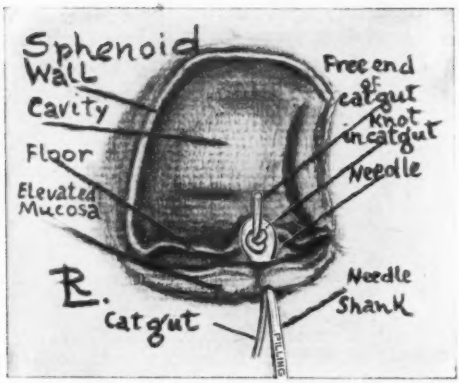


This instrument is useful for the measurements of the depth of the anterior and posterior ethmoidal arteries, the anterior and posterior face of the sphenoid and the optic foramen. (Average measurements obtained from 150 skulls will be published in another paper.) It has also been used through the nostril to measure the distance of the anterior and posterior faces of the sphenoid from the alae nasi, against which the thumb piece is brought.

A SPHENOPALATINE NEEDLE: This needle is used for the ligation of the sphenopalatine artery. It is threaded, and a knot is placed at about a quarter of an inch (0.6 cm.) from the end of the catgut. When the catgut is stretched, the knot will become engaged into the eye of the needle (on the shank side) and the stiffness of the catgut will keep the free end

*These instruments are made by George P. Pilling & Son Co., Philadelphia.

(beyond the knot) in an upright position. The elevated mucosa is pierced while the knot is held engaged into the eye of the needle. When the point will emerge on the upper surface of the mucosa, the free end of the catgut will spring up, beyond the bony floor of the sphenoid in a position that it is easily seen and grasped with a forceps. The knotted end of



the catgut is then pulled out through the external opening while the instrument is kept in place (the needle will, during the pulling, protect the artery from the sawlike motion of the catgut). Without being unthreaded, the instrument is then withdrawn, and the ligature is slid toward the artery and tightened.

1713 Pine Street.

AMERICAN LARYNGOLOGICAL AND OTOLOGICAL SOCIETY, INC.

Fortieth Annual Meeting, April 3, 1934.

(Continued from March issue.)

Symposium—Newer Clinical Approaches in Otolaryngology.

1. **Nutritional Influences.** Dr. William Weston, South Carolina Food Research Commission, Columbia, S. C. (By invitation).

2. **Sympathetic Influences (Autonomic Level).** Dr. Francis B. Blackmar, Columbus, Ga.

3. **Insulin Therapy.** Dr. Samuel M. Beale, Sandwich, Mass. (By invitation).

DISCUSSION.

DR. THOMAS W. MOORE: Dr. Weston tells us that he knows of no substance more variable in its chemical content than milk and that this applies both to its mineral and vitamin properties. It has been known for years that the iodine content might be increased by adding that substance to the animal's food, especially in certain forms of seaweed. Also that where alfalfa is fed the calcium content may be increased, as this plant will only grow on an alkaline or neutral soil, and that this condition is brought about by applying lime as fertilizer, which in turn is taken up by the plant, is readily absorbed by the animal and given off, partly, at least, in the milk. We also know that the quantity of milk may be greatly increased by a rich protein diet to such an extent that the life and usefulness of the animal machine may be much shortened, but I had thought the vitamin element remained unchanged. Milk, as you know, is usually found on our vitamin lists as possessing vitamins A, B, C and G, and to the less informed dietitian, it has been a great sheet anchor, taking care of many conditions where various vitamin deficiencies were manifest.

His paper shatters many of my idols in a most convincing manner. His statement that cabbage and the other members of that botanical group may produce goitre is startling. I believe that it was Plato who said that a diet of cabbage would cure all diseases, and I fear that unless we curb my good friend Weston, his teachings will eventually drive us all to a diet of spinach and carrots.

Dr. Beale's paper, which seems to be wholly clinical, astounds us with the number of varied diseases in which he has found insulin useful—truly, as he states, we do not know how it acts. He sent to me his original paper of about 80 pages, representing a tremendous amount of work and giving his reasons for conclusions drawn, much more elaborately than it is possible in the short paper he presents today. Whether we can accept his views unchallenged or not, we must acknowledge our indebtedness to him for bringing to our attention what may prove a very useful medicament in a field apart from that usually assigned to it.

We know that insulin has been used in some cases of delayed healing after mastoid and other operations with most gratifying results.

I believe that there is a field for investigating the use of insulin in conjunction with a laboratory where the cases may be studied clinically and at the same time the blood chemistry throughout the treatment of each case.

A recent paper in the Journal of the A. M. A. cites cases of hypoglycemia or hyperinsulinism that have been cured by removal of diseased portions of the pancreas where adenomas existed in that organ, at least three of the above cases reported were definitely proven to be carcinoma of the pancreas. This seems to conflict with Dr. Beale's observations.

I am fully in accord with Dr. Beale's suggestion that primitive people are free from cancer and that this is probably due to the kind of food eaten and its method of preparation. This is brought out very dramatically by Dr. Weston in his reference to McClendon's studies of the Japanese.

Undoubtedly much of our pathology is due to endocrine disturbance and much of it will be remedied as we learn how to correct this and put it in proper balance.

Will Dr. Beale tell us, if he has not at times, after administering insulin, had symptoms of hyperinsulinism, the so-called hunger disease, where we have hunger associated with weakness, nervousness and the other manifestations of hypoglycemia, sometimes developing coma and convulsions? I wonder if he has not found cases where even the small doses he administered might not augment this condition. Also, if he has any guide for its administration besides the symptoms of the varied and numerous diseases in which he has found it beneficial.

These papers have proven most interesting in opening up new lines of thought, but we have much careful study yet to do before we can satisfactorily treat many of the ills of otolaryngology by diet alone.

A recent editorial in the Journal of the A. M. A. reminds us that in a series of experiments 30 gm. was the smallest amount of sodium citrate that produced a shift in the acid base equilibrium of the blood drawn before breakfast, and further that the alkaline ash contents of one pint of orange juice is only equivalent to 2 gms.—30 grains of bicarbonate of soda; also that the acid ash content of beef and oysters is correspondingly small. However, there are undoubtedly border line cases where the continued use of predominating acid or alkaline ash foods do make an impression.

MINNESOTA ACADEMY OF OPHTHALMOLOGY AND OTO-LARYNGOLOGY.

SECTION ON OTO-LARYNGOLOGY.

Meeting of Dec. 14, 1934.

Dr. J. S. Reynolds, President, presiding.

Dr. Elmer O. Dahl, Minneapolis, reported the following case of "Osteitis Fibrosa of the Maxillary Sinus." (Lantern slides were shown.)

According to Knaggs of London, who has studied this disease extensively, osteitis fibrosa is a name given to a disease of bone in which part of the osseous framework and its contained marrow are replaced by fibrous tissue. It is essentially a disease of the long bones. Osteitis fibrosa was first recognized as a clinical entity in 1891 by von Recklinghausen, and, more recently, Bloodgood has written articles on this subject. Though its name implies inflammation, in the primary type its inflammatory character is doubtful. This secondary type may be associated with inflammatory changes. Cyst formations are very common. In the St. Bartholomew Hospital Museum is a superior maxilla whose alveolar process, greatly increased in size, is transformed into a dense bony mass which reaches the floor of the antrum though that cavity has not been affected. This case was of the secondary type following alveolar infection.

The process includes removal of osseous tissue and its replacement by fibrous tissue in which ossification takes place in an attempt to replace the damage. Whether it is the result of toxins or bacterial infection is not certain. A few authors have found the calcium content of the blood high and in one case reported there was a tumor of a parathyroid gland.

The author's patient presented herself on April 4, 1934, complaining of occlusion of the right nostril and beginning occlusion of the left nostril. She was a female, age 27 years, and slender. The family history and previous personal history were essentially negative.

Nasal examination showed a bulging lateral nasal wall which pushed the septum over and partially obstructed the opposite nostril. There was some bony swelling of the face on the affected side.

The patient was sent to a roentgenologist and the following diagnosis returned:

1. Tumor arising from right antrum. a. Probable carcinoma; b. Possible Ewing's endothelioma.

The patient was taken to the hospital and a Caldwell-Luc operation was commenced. No antrum cavity was present and all the bone encountered seemed the same; that is, the walls as well as the center of the antrum were involved in the same process and there was no demarcation between them. The structure was distinctly bony, but not quite as hard as normal bone. There were no cysts. This writer did not recognize the pathology at the time of operation, nor did the pathologist who was present at the operation. A cavity approximating the size of a normal antrum was excavated and the obstruction to the nostrils was removed.

Pathological Report: Gross: The curettings from the right maxillary sinus contain hard, bony granules.

Microscopic: Tissue consists of spicules of bone which are quite cellular. Around these spicules of bone there is dense fibrous connective tissue with some small round cell infiltration. No evidence of malignancy present.

Diagnosis: Osteitis fibrosa.

The patient's convalescence was uneventful. Radiation therapy was decided on. She was given radiation anteriorly and laterally to crossfire the region of the right maxillary area. A total dosage constituting a threshold erythema was given over each portal of entry. The treatments were given from May 12 to 17, 1934. A recent X-ray taken in December shows no apparent progression of the disease.

Conclusions: 1. The progress of the growth may have been arrested by the X-ray treatments, although the writer thinks that sufficient time has not elapsed to justify such a conclusion.

2. Although no malignant cells were found, a steady progression of the disease must necessarily have a fatal result.

3. Complete surgical eradication of the disease could be accomplished, but it would necessitate a complete removal of the maxillary bone, and this was deemed inadvisable because of the operative risk and the resulting deformity. The patient is now free of symptoms and the progress of the disease seems to be arrested.

4. The writer has been unable to find any report of a similar case in the literature.

DISCUSSION.

Dr. F. Z. Havens (by invitation) said that much confusion exists regarding the condition known as osteitis fibrosa. The pathologic process in this disease is essentially that of proliferation of fibrous tissue and sometimes the formation of new bone; therefore, it is a healing process. Apparently, it follows some type of destructive lesion.

Some writers have thought it to be a manifestation of faulty metabolism of calcium. Others have thought it to be the result of infection, while still others have considered it to be toxic in origin. Knaggs said he believed osteitis deformans and osteitis fibrosa to be simply different expressions of the same disease, determined by dissimilar resisting powers of the victims.

An exhaustive study of osteitis fibrosa and related conditions has been made recently by Geshickter and Copeland, who worked with Bloodgood. It is their conclusion that osteitis fibrosa, giant-cell tumor, epulis of the alveolar border and the xanthoma type of giant-cell tumor of the sheaths of tendons are all fundamentally related with disturbances of the normal process of conversion of cartilage into bone. In 78 per cent of their cases the destructive lesion preceding the osteitis fibrosa had been a giant-cell tumor. Other causative factors were found to be foreign body, abscess, osteomalacia, rachitis, and so forth.

Osteitis fibrosa occurs most commonly in the first or second decades of life and generally affects the long bones. Apparently, the bones of the face rarely are involved. There is a generalized osteitis fibrosa cystica, which apparently is the result of disturbance of the metabolism of calcium, and which is associated with hypoparathyroidism.

Dr. Havens then demonstrated a slide of a roentgenogram of the mandible in a case which has been considered to be osteitis fibrosa, but in which microscopic confirmation was lacking because the tumor had never been explored. He said that this was the only case which he had seen which might belong to the type under discussion. He then showed several other slides illustrating some conditions which might be confused with osteitis fibrosa, including osteitis deformans, hypoparathyroidism, giant-cell tumor of the upper jaw, osteogenic sarcoma of the mandible and leontiasis ossea.

Dr. Arnold Schwyzer (by invitation) read a paper entitled, "Congenital Fistulae of the Neck," and showed numerous lantern slides of the condition, including the embryological development.

NASHVILLE ACADEMY OF OPHTHALMOLOGY AND OTO-LARYNGOLOGY.

Meeting of Dec. 17, 1934.

Dr. W. W. Wilkerson, Jr., Chairman.

Case of Lateral Sinus Thrombosis. Dr. W. G. Kennon.

Dr. Kennon reported the case of W. B., white, male, age 8 years, who was admitted to St. Thomas Hospital, May 14, 1934, with the diagnosis of bilateral acute suppurative otitis media developing as a complication of measles. Spontaneous perforation of the left drum membrane occurred 13 days and of the right 10 days prior to admission. There was very little pain, but a profuse purulent discharge from both ears. He had had an irregular type of fever, never being subnormal, but had reached 106° on several occasions. Five days previous to his admission he had a chill, following which his temperature reached 105°; two more chills occurred, one the morning of admission. Two days prior to admission, swelling was noticed below the tip of the left mastoid. On admission, four hours after a chill, his temperature was 104°.

Examination: There was a profuse purulent discharge from both ear drums, marked tenderness over the tip of the left mastoid and over the entire right mastoid. Marked swelling below tip of left mastoid, which appeared to be due to swollen lymph nodes, though this was possibly due to a Bezold perforation. There was no sagging of the posterior superior canal wall in either ear.

Laboratory: R.B.C., 3,000,000; W.B.C., 7,500, with 74 per cent polys. Blood culture showed streptococci at end of 36 hours. X-ray showed apparently clouding and bony destruction of both mastoids.

Both mastoids operated on the day after admission. The left mastoid showed bone softened throughout; most of the cells filled with edematous mucous membrane; small amount of pus found in tip cells and in various areas; the lateral sinus showed a perforation about 1 mm. in diameter from which pus discharged with each pulse beat. The sinus wall was yellow. Exposure of sinus backward for about one-half inch was made and though no instrument was introduced into the lumen of the sinus, free bleeding occurred. The same thing occurred on exposure in the direction of the jugular bulb. Bleeding from the lateral sinus was controlled by iodoform gauze packing. There was considerable bone bleeding. Following operation on right mastoid, in which more pus was found, the left jugular vein was exposed and found to be collapsed; it was ligated with silk.

Immediately following operation a transfusion of 250 cc. of citrated blood was given. Patient was given nine blood transfusions, two of which were from a patient who had recovered from a streptococcus blood stream infection. Remarkable improvement occurred following both of these transfusions, his temperature falling almost to normal. His last rise of temperature occurred at the end of seven weeks. He is at present in good condition.

Interesting points in this case:

1. The long-continued septic type of fever.

2. The necrosis of the sinus wall with free pus in the sinus discharging beneath the sinus plate.

3. The remarkable response to blood transfusion.

4. The ultimate recovery.

THE NEW YORK ACADEMY OF MEDICINE.

SECTION OF OTOLARYNGOLOGY.

Meeting of October 17, 1934.

Dr. Marvin F. Jones, Chairman; Dr. Wallace Morrison, Secretary.

The Medical Aspects of Hearing Conservation in the New York Schools. Dr. E. P. Fowler.

(To be published in a subsequent issue of THE LARYNGOSCOPE.*)*

Physiological Basis of Physical Measures in Otolaryngology. Dr. Richard Kovacs.

(To be published in a subsequent issue of THE LARYNGOSCOPE.*)*

A Critical Analysis of Methods of Physical Therapy in Rhinolaryngology. Dr. Lee M. Hurd.

(To be published in a subsequent issue of THE LARYNGOSCOPE.*)*

Scientific Status of Physical Therapy in Otology. Dr. A. R. Hollender.

(To be published in a subsequent issue of THE LARYNGOSCOPE.*)*

DISCUSSION.

DR. HENRY HALL FORBES: I do not know of any meeting which I have attended for a long time which I have enjoyed as much as this one tonight. It is highly instructive. Our Chairman has tried, as he told you, to bring to you those men who are prominent in this work of physiotherapy. I feel almost embarrassed to come up here and attempt to discuss it. I only do so because I am deeply interested in this subject. There are a number of points that came to me very vividly as I heard Dr. Kovacs read his paper. As I had the opportunity of reading these papers before this evening, I have prepared here a brief summary which I will read.

The subject selected by our Chairman and so interestingly presented by the readers of the papers gives to us a very up-to-the-minute resume of the subject of electrosurgery, both medical and surgical, as well as the physiological effects.

On Dec. 3, 1930, I discussed this subject at the invitation of the New York Physiotherapy Society, and also in December, 1932, when in this Section, Dr. Hurd presented his paper on the use of electrosurgery in diseases of the ear, nose and throat. In my discussion, feeling I could but voice the positive statements of Dr. Hurd, plus a short resume of my own work, I thought I had spoken my little piece; however, the presentations mark a further step in the possibilities and acceptance of the work of the scientific workers in this field of therapy, a field of work now covered and applied by eminent members of our local and national societies. It is no longer play work. Let us then congratulate and accept the results as given to us tonight by the readers of the papers as well as one or two others whose names I will mention later.

Covering a few remarks by Dr. Kovacs in relation to heat, I remember very distinctly one of the remarks of my old professor of surgery in connection with some pleuritic conditions. He said to the class: "Gentlemen, you will never have anything give comfort to the patient as much as the luxurious warmth of a flaxseed poultice." The heat there is applied simply on the

surface. It happened while I was an interne that there was a patient whose chest had been opened for empyema. We were interested to see how far the heat penetrated into the body, and we put our thermometers through the opening in the chest wall while applying external heat, hot water bottles and pads. We found no rise of temperature in the pleural cavity. Tonight Dr. Kovacs told you what heat will really do. It will penetrate, and not only penetrate, but with the short wave apparatus we are using now the body temperature will rise. In addition, although he did not touch on this point tonight, the temperature has been recorded as high as 107° to 108°, and it will stay up for four or five hours before coming down to normal. As Dr. Kovacs and Dr. Hollender mentioned, you see the penetrating powers of the medical diathermy. It is no longer a plaything. It is no longer used just for the comfort it gives a patient. It certainly has therapeutic value.

I do not want to bring up the question of priority in this brief discussion, but I would like to bring to your attention one thing. I think the members of the Academy and every man in New York should feel proud over the reference I would like to make to the early use of high frequency methods in our field of work. In 1906, Dr. Finlay Cook, one of the internes of the Presbyterian Hospital, started to work with me. We had at that time one of the first X-ray machines for use in a private office. There were only a few in New York City at that time and this was a very old-fashioned affair. He became very enthusiastic and used it not only for taking X-ray pictures, but also therapeutically. He also used the vacuum tubes. In working with them he noticed that a spark from the metal handle caused a superficial burn. He experimented with this and reported it in December, 1907, under the heading of high frequency metallic discharge (see New York Medical Journal, 1907). He did not even have a name for it. There had been some work done on the use of this current for the cure of certain malignant diseases by a worker in Paris, but Dr. Cook did not know of that. It was not until 1909 that Pozzi reported his work, using the term fulguration. In 1910, Dr. William L. Clark, who was one of our outstanding authorities in the use of this method in surgery, reported this method and called it electrodesiccation, the monopolar method. Dr. Cook reported some seven or eight cases where he attempted removal of the tonsils with this method. I am a little enthusiastic over this method because I had a hand in doing this work. My first use of the current, both for tonsils and nasal polypi, goes back also to that time, 1905 and 1907. On the tonsils fulguration is really play. It does not do the work, of course, of our present surgical diathermy.

I have never doubted the value of electrosurgery and have been interested in every phase of its development in our field of otolaryngology. May I, therefore, Mr. Chairman, quote one or two whose work must add to the authoritative value of the work with electrosurgery. Every member of the medical profession is interested in any and all methods of treatment which will benefit the patient and advance the science of medicine and surgery. I do not think that Dr. Hurd and I are alone, and I agree with all the work he has accomplished in advancing the use of electrosurgery in our work of otolaryngology. We are all agreed that it can destroy lymphoid tissue. Why not make a study of its use in selected cases, either its medical effects or its surgical destructive possibilities. I have used electrosurgery for years and will continue to do so. Again we have the X-rays, used now so extensively for their therapeutic action, and we all know its value. We all are in accord and realize the sacrifices the pioneers made in their efforts to improve the technique of its use in disease. Our methods, our technique, may change, but the work goes on.

Those who wish to study the subject may read the recent book by Dr. Kovacs, and also one written by Howard Kelly of the Johns Hopkins Hospital, both outstanding medical men of high repute. Dr. Kelley dedicates his book to the Department of Surgery of the Johns Hopkins University, "As a tribute to their recognition of the importance of the incoming era of electrosurgery as a coadjutor." Dr. Kelley goes so far in his advocacy of electrosurgery as to say, "Electrosurgery opens up a vista we believe destined in no small measure to replace the scalpel, the ligature and the hand contacts

with wounds, as well as to pare down the number of those listed as the inoperables by skilled surgeons."

A study of the technique must be made. Few of us had 100 per cent success in our early surgical enucleations in tonsil work. Why condemn electrosurgery without studying fully the results as they occur in competent hands? One of the last pictures shown by Dr. Hurd here gave me a great deal of encouragement for its use in removing keloids. I think every surgeon here who has had any experience in attempting to control a keloid growth will be very glad to hear the results Dr. Hurd had.

Mr. Chairman, I thank you. I hope this program will bring attention to the work which the readers of the papers tonight are trying to do for us. It has a positive value in surgery today.

Dr. E. Ross Faulkner: I just want to offer a word of commendation to Dr. Fowler for his work in hearing conservation. I know that he has been doing this work for years, giving liberally of his time and experience, and carrying on a very fine public service. Perhaps it may make the rest of us feel a little guilty that we have not taken a fuller part in this work. We do not need many statistics to show us what an urgent need this is, especially in our own home city. I have always felt that perhaps ear specialists have not quite co-operated with the local agencies and the League for the Hard of Hearing as well as we might have done. In some parts of the country the otological societies are in very close touch with the Leagues for the Hard of Hearing, lending their influence in support of this service. Our attention tonight has been called to this work by the New York League for the Hard of Hearing. We have an organization here which for the last four years has carried on a very wonderful social service, and perhaps we have not known as much about it as we should. The League has carried on its activities with the most indomitable courage through very bad times with a wonderful efficiency. This work should be supported by every citizen in this city, whether he is affected with deafness or not. It is a great service. I feel that I for one want to solicit the members of our Section to give it greater support. I want to see a close affiliation, so close that our Advisory Council should appoint a representative otologist to represent the League on our Board of Directors. I feel that that is very essential. I feel that would eliminate the objections that have been made in the past. It would be a great thing if we were to become members of this organization that deserves the support of all kinds of other organizations of this sort in this city.

Dr. Harmon Smith: The honesty and integrity of purpose as communicated by the readers of the papers tonight are quite refreshing. At the same time there are elements therein about which we, who are not experienced and have not had the opportunities they have had of applying these things, remain somewhat in the dark. One of the distinguished discussors, Dr. Forbes, who has preceded me, is rather wrong in his historical dates, as he doesn't go far enough into the past.

I was assistant to the Chair of Tuberculosis at the Post-Graduate Hospital in 1899. At that time we were applying the X-rays for the cure, or at least for the amelioration of pain, in tuberculosis of the larynx. Again, about 1904, I was the first to apply fulguration for the obliteration of papilloma of the larynx in children. It destroyed the papilloma, although they often recurred, and not infrequently a short circuit occurred between the speculum and the applicator. However, being discouraged with it I gave up this electrotherapy, but now it is being employed successfully owing to better technique.

In due course of time I took up ultraviolet ray application, particularly for diseases of the ear. I still have an apparatus for this purpose secreted in my attic which I should be glad to give away to anyone who wishes it, because I did not have sufficiently good results to justify continuing its use. The reason for my failures was, ignorance of application, inadequate instruments and lack of patience. The same thing applies to electrotherapy. We tried it at the Manhattan Eye, Ear and Throat Hospital, treating tonsils and lymphoid tissue by the application of the high frequency current and various

other forms of electrical apparatus. We did not pursue it sufficiently long to acquaint ourselves with the proper technique for reduction of these lymphoid masses.

I have seen several patients who have been patients of Dr. Hurd, and I have been deeply impressed with the good results where proper methods have been employed. With intelligence and the knowledge of how to apply them, the ultimate results have been wonderful.

There is one outstanding case of a distinguished pediatrician who had enlarged tonsils which had troubled him for years and had also affected his ears more or less. I suggested operative removal, but being very busy he could not spare the time. During the past year he applied to Dr. Hurd for their removal by high frequency application. The tonsils have been entirely removed, leaving no vestige in the tonsillar fossae, his hearing has improved, and he lost no time from his business. Success depends upon the individual who makes the application.

My endeavors to remove tonsils resulted in a short circuit, and I discarded the apparatus and refused to handle it. For success one has to know the technique of application and acquire the knowledge of anesthetization and also dosage. While yet in the experimental stage, those who have pursued it with intelligence have had good results.

Dr. George B. McAuliffe: I would like to speak a word of praise for Dr. Fowler in his attempt to canvass the schools for cases of deafness. It is a task which he has only begun. It would take all his time to go through the schools to find cases of possible deafness. Still, it is an effort in the right direction. It is too bad that his efforts are not supplemented by those of other members of the profession in the treatment of these cases. I have been aurist of the School for the Deaf in 23rd Street. I have been dealing with deaf children for the past 26 years and have seen a good deal of this work. All the cases that are referred to the principal of the school as having some defect in hearing, all those children who show stupidity or do not advance in their classes, are sent to me for examination for possible deafness. I examine, therefore, at least 600 cases a year. I have 500 children now under my care down in the school. It is deplorable that when I discover in these children sent to me from the different schools a slight amount of catarrhal deafness and advise them to go to different clinics because they cannot afford private treatment, they get absolutely no treatment. They come back with the statement that the doctor said they are all right. In other words, children do not interest them unless they are operable. The majority of dispensaries want only operable cases. So I have in the school a clinic in which I give inflations, nasopharyngeal applications and such treatment as is adapted to their condition.

I am afraid that the public has gone audiometer mad. The audiometer is a wonderful instrument and we ought to use it, but it is unfortunate that it has been put into the hands of the laity. All the high schools have an audiometer. Most of them are hidden away in closets and are never used. Some of the C.C.C. men go around the high schools and take audiometer tests, and they do not know a thing about the ear. Cases are sent to me as cases of deafness with only 10 per cent loss of hearing. I am sure that if I took audiometer tests on all of you here tonight, you would all have from 10 to 25 per cent loss. One case was brought to me by one of these men with 15 per cent loss. I said that the child was all right. He needed only a few inflations and some mild treatment. I tested the hearing of this man who brought the child down and he had a 30 per cent loss.

There ought to be a little better co-operation on the part of the dispensaries in the matter of treatment. Dr. Fowler has really put the work of the League for the Hard of Hearing on a scientific basis. My work has never been publicized, but goes on from year to year. I see these cases, examine them, get their percentage of loss and determine whether it is catarrhal or a nerve deafness. If there is a real handicap, that is, 50 or more per cent loss of hearing, they generally take up lip reading. Lip reading was taught down

there probably before any other place in the city. We find some of these boys and girls there who, after having their eyes refracted, can read lips across the room. It is a wonderful work that is being done in that branch of otology.

Another thing which has struck me particularly in this work in the past 25 years is that most of the nerve cases, cases that are irreparable, have been subjected to removal of tonsils and adenoids. These cases never get better, cases where the nerve has been damaged by the pneumococcus or by influenza or cerebrospinal meningitis. Most of them come back with the idea that the tonsils and adenoids had been removed to improve the hearing. If the aurist were scientific, he would know that that would have absolutely no effect on the ears. The damage is done. Those cases which follow cerebrospinal meningitis will go to the aurist and be given hopes that they will probably improve as time goes on. One of them was told that "other nerves will take on the function of hearing." I do not know what the aurist meant by that. There is a 100 per cent defect in these meningitis cases and they never will get better. The invasion of the labyrinth is overwhelming, like a mass of lava, and the auditory nerve is absolutely destroyed. This attitude shows ignorance on the part of the aurists and they ought to know better.

I wish to mention another phase of the subject, the examining of young children. Very few aurists bother to examine them simply because they cannot get down to the child's level. You have to translate your terms into terms of the child's own understanding. For instance, when using a tuning fork, ask the child if he hears the music. Then, by patience, you will be able to elicit the fact whether there is catarrhal or partial nerve deafness. There are many cases of partial nerve deafness. There are some cases in the schools with 30 to 40 per cent loss who get along pretty well, but they never will get better. It is foolish for the handicapped deaf child to try to keep up in the regular schools. There is a great deal of talk about islands of hearing. The child, however, needs conversation, and voice. The sooner the handicapped deaf child takes up lip reading the better for his education. The results are surprising. Beginning with a mental equipment of 3 years at the age of 7 or 8 years, by the time they are 15 these children are, surprisingly, equal to other children of their own age. With a loss of 50 to 60 per cent, the child should take up lip reading.

DR. DENNIS J. MCDONALD: I wish to say only this. I founded this particular school which Dr. McAuliffe told you about. I was before the delegates of the American Medical Association on this subject. There are now 14 schools in the United States and one in Japan.

DR. EDMUND P. FOWLER: I want to thank the discussors of the brief report I made. You understand it is not I who am doing this work, it is the New York League for the Hard of Hearing which is doing the work, giving their services to do a thing which the City of New York should do and pay for. On their part it is purely philanthropic work. These people in the League have very little support from us, by the way, and they should have the support of every one of us.

The idea of doing the 4A and the 2A audiometer tests is to prevent borderline children from uselessly going to the clinics. We find, however, that many (examined under quiet conditions) are down only 15 or 20 units, and yet have marked lesions in the ears. These lesions may be the cause of severe deafness in the future. If you examine the people in this room you will find many of us down 20 to 30 units and yet few who think themselves deafened. The reason is that we all speak so loudly that we overcome such degrees of deafness and so do not know we have any loss. Examinations of children are necessary in order to discover deafness and institute measures to prevent more serious deafness in the future. Speaking of the audiometers forgotten in the schools, we have taken these audiometers from the schools and are using them now for testing these children. We had no money to buy audiometers.

THE NEW YORK ACADEMY OF MEDICINE.

SECTION OF OTOLARYNGOLOGY.

Meeting of Nov. 21, 1934.

Dr. Marvin F. Jones, Chairman (presiding); Dr. Wallace Morrison, Secretary.

Symposium on Upper Respiratory Tract.

I.—The Relationship Between Infections of the Upper Respiratory Tract and the Ear. Dr. James G. Dwyer.

II.—Upper Respiratory Infections from the Pediatric Standpoint. Dr. Louis C. Schroeder.

III.—Endoscopy in the Treatment of Diseases of the Upper Respiratory Tract. Dr. John D. Kernan.

(To be published in a subsequent issue of THE LARYNGOSCOPE.*)*

I.—The Relationship Between Infections of the Upper Respiratory Tract and the Ear. Dr. James G. Dwyer.

DISCUSSION.

DR. JOHN R. PAGE: I am glad to have heard Dr. Dwyer on this subject, as I think he is better qualified than most of us to write on such a very broad subject. I am interested, but I am unqualified to discuss the effect upon the ear of the vitamin deficiencies, and the effects of endocrine and allergic disturbances, for I know very little about them. My interest was caught, however, by Dr. Dwyer's calling attention to the bad effects on hearing from repeated occurrence of negative pressure in the middle ear and the exudate of fluid. At times, without pain or fever, it is often left to become absorbed, and the more I see of this class of case the more I am inclined to give them a prompt relief by paracentesis; not myringotomy, but usually paracentesis. I feel sure from my experience that permanent impairment of hearing is much less apt to occur when this is done than when the fluid is left to be absorbed or expelled.

In reference to acute infections of the middle ear, Dr. Dwyer very kindly referred to some investigations I have made during the past year which have proved the advisability of early incision or paracentesis when proper precautions are taken. The claim that myringotomy produces often more trouble has been pretty well proved to be a fallacy. I was very glad to receive today a letter from Dr. Roberts of Bridgeport, in which he said he had heard my report in Boston on this work for the first nine months of the year. My idea in doing this work was to take up the infections of the middle ear through the different seasons with some reference to their prevalence, and their virulence as recorded in their effects on patients. I received his letter with his report of observations made in 828 consecutive cases of acute middle ear abscess. The report showed the value of early ear incision. In his summary he says that among ruptured drums, one in four came to operation; whereas, in cases in which myringotomy was performed before rupture occurred, one in 20 came to operation (mastoidectomy).

I have not seen enough autopsies on cases of mastoiditis and sinusitis where I have found the mastoid and tympanum infected from the petrous pyramid and sphenoid sinus to make me think that we can be definitely assured that this was alone the pathway of infection. It is reasonable to think that it can

occur, but I do not think that it occurs very often. I think that pansinusitis, otitis media, mastoiditis and involvement of the petrous can all occur simultaneously from the nasopharynx. I have seen such a case as Dr. Dwyer described which was essentially an osteomyelitis of the base of the skull, where every bone of the base of the skull was involved, even the basilar process of the occipital bone. The whole base of the skull was eroded. In such a case, however, I think if infection of the petrous apex came from the sphenoid it was met more than half way in the pyramid by infection from the middle ear and mastoid which came up through the Eustachian tube.

DR. EDMUND PRINCE FOWLER: Everything that Dr. Dwyer has said is generally accepted. I do not use the word catarrhal, as I believe it misleading and soon to be obsolete. There appears to be much unnecessary mystery about the petrous infections. Petrositis of the outer portion or tip may occur as an osteomyelitis or osteitis exactly as these may occur in the mastoid bone, depending upon the pneumatic or myeloid character of the bone. As with the mastoid, efficient and timely drainage will allow recovery. Efficient and timely drainage is, however, often difficult to obtain.

I am sure that Dr. Dwyer would agree that all his explanations are in some way unsatisfactory from the standpoint of etiology. For instance, anemia, avitaminosis, endocrine unbalance, allergy, faulty nutrition, unhygienic surroundings, general and focal infection, repeated head and chest colds, and sinus infections, and so forth—all of these occur in thousands of cases without any apparent involvement of the middle ear. Moreover, from what appears to be equal provocations, no otitis develops, or one ear will suffer and the other will escape. I am such an example, having been subject all my life to most violent sinus and upper respiratory infections with and without bronchitis, and in no instance an involvement of my ears. My hearing is average normal except at one frequency (near 4000), which is a common defect in those subjected to much gun fire. Moreover, Dr. Law has made repeated X-rays of my sinuses and finds them negative. Why have I escaped ear trouble when there are thousands who have not been so fortunate? The answer, of course, is, "We do not know."

My own conception of the middle ear infections in relation to the upper respiratory tract, as I have repeatedly stressed, is that the middle ear and Eustachian tube are just as much a part of the upper respiratory tract as the frontal sinus and the frontal duct, and broadly speaking, the ethmoids and their openings, and the maxillary sinuses. The normal middle ear is better protected; it may be because of the long, ciliated Eustachian tube, but the frontal sinus is also separated from the nose by a long passage.

The position of the Eustachian tube is not so important as is usually made out, because for nearly half of the 24 hours most of us, whether in infancy or in adult life, are reclining supine, or prone, or on one side or the other, so that one Eustachian tube or the other cannot remain long in a dependent position relative to the middle ear. One tube is, in fact, usually on a level with or higher than the middle ear. I have, therefore, always thought that there was a good deal of doubt in the contention that the horizontal position of the tube made the baby more subject to otitis media than the adult. Why should not the shortness and larger proportional diameter of the tube in the baby be cited as reasons for better drainage and therefore for better avoidance of and quick recovery from infection? Remember, the baby lies much of the time flat on his little belly, his tubes being dependent.

What happens when inflammation attacks the head spaces? Is it limited to one cell, or two cells, or a small group of cells? No. It regularly attacks simultaneously a considerable expanse of nasal mucous membrane and the contiguous mucoperiosteum of the sinus spaces.

(To be continued in a subsequent issue.)